DOCUMENT RESUME

ED 240 158 TM 840 094

AUTHOR	Adams, Morgan; And Others
TITLE	Computer Use in the Portland Public Schools, An Evaluation: Computer-Based Instruction, Computer Literacy Programs, Computer Management.
INSTITUTION	Portland Public Schools, OR. Evaluation Dept.
PUB DATE	Nov 83
NOTE	156p.
PUB TYPE	Reports - Evaluative/Feasibility (142)
EDRS PRICE	MF01/PC07 Plus Postage.
DESCRIPTORS	Basic Skills; *Computer Assisted Instruction; *Computer Literacy; Computer Programs; *Computers; Databases; Educational Administration; Elementary Secondary Education; *Program Evaluation; *School Districts; *Student Records
IDENTIFIERS	*Portland School District OR

ABSTRACT

This evaluation of the use of computers in the Portland Public Schools (Oregon) is divided into three main sections. (1) Computer based instruction (Chapter 1, Computer Assisted Instruction, and Chapter 2, Prescription Learning) evaluates two different systems which use computers as an aid to basic skills instruction in mathematics, reading and language usage. (2) Chapter 3, Computer Literacy Programs, evaluates instructional programs concerning computers and their use in society. (3) Chapter 4, Computer Management, evaluates the use of the computer for maintaining an on-line student information system in local high schools. The appendices include descriptions of computer use and computer-based instructional program software; curriculum match between computer-based instructional programs and the Portland Achievement Levels Tests; and tables presenting standard deviations, growth and rate of growth for participants by grade level and software, by school and grade level; and the effects of prescription learning programs by school. (PN)

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EVALUATION REPORT ON COMPUTER USE IN THE PORTLAND PUBLIC SCHOOLS

PPS

COMPUTER-BASED INSTRUCTION

COMPUTER LITERACY PROGRAMS

COMPUTER MANAGEMENT

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COMPUTER USE IN THE PORTLAND PUBLIC SCHOOLS: AN EVALUATION

- COMPUTER BASED INSTRUCTION
- COMPUTER LITERACY PROGRAMS
- COMPUTER MANAGEMENT

November 1983

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Published by
Publication Services
Portland Public Schools
Portland, Oregon

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INTRODUCTION TO
COMPUTER USE IN THE PORTLAND PUBLIC SCHOOLS

This evaluation of the use of computers in the Portland Public Schools is divided into three main sections:

(1) COMPUTER-BASED INSTRUCTION

Chapter 1, Computer-Assisted Instruction, and Chapter 2, Prescription Learning, cover two different systems which use computers as an aid to basic skills instruction in mathematics, reading and language usage.

(2) COMPUTER LITERACY PROGRAMS

Chapter 3, Computer Literacy Programs, describes instructional programs concerning computers and their use in society.

(3) COMPUTER MANAGEMENT

Chapter 4, Computer Management, presents the use of the computer for maintaining an on-line student information system in local high schools.

Computer-Based Instruction

To help students attain basic skills in mathematics, reading and language usage, the Portland Public Schools in the fall of 1981 implemented two computer-based instructional programs, Computer-Assisted Instruction (CAI) and Prescription Learning. Both programs were provided as supplements to regular classroom instruction for low-achieving students.

While both CAI and Prescription Learning were implemented at the elementary and secondary levels, this evaluation addresses program effects at the elementary level only; lack of adequate measures of the key dependent variables of student achievement in mathematics, reading, and language usage for secondary student groups made a similar evaluation unfeasible.

This part of the evaluation report investigates the effects of the different CAI software curricula and the Prescription Learning curriculum on low-achieving elementary students in attaining basic skills in mathematics, reading and language usage.

Use of computers at the secondary level for instruction in foreign language, geometry, accounting and data entry were not evaluated in this report.

Computer Literacy Programs

Individual elementary and secondary schools in the Portland Public School District have initiated their own computer literacy programs in hopes of educating their students and staff in the programming and use of computers. This part of the evaluation report gives the results of a survey addressing the curriculum design and the extent of student participation in these computer literacy programs.

Computer Management

During the fall of 1982 a pilot data base management program for storing student information and recording attendance was implemented in two high schools. The last part of the evaluation report describes the effects of the pilot management programs.

Table 1 identifies the 22 schools which participated in the evaluation of the three areas of computer use in the Portland Public Schools during the 1982-83 school year. The level of involvement and the total number of students participating at each level is noted. A complete description of computer use in each of the 22 schools is presented in Appendix A.

Table 1
Schools Participating in the Computer Use in the
Portland Public Schools Evaluation, 1982-83 School Year

		Computer-Based Instruction									
		Prescription Learning		Computer-Assisted Instruction			Computer Literacy				Computer Management
		Reading/Lang. Usage	Mathematics	Mathematics	Reading	Language Usage	Introductory Course	Course 2	Course 3	Course 4	On-Line Student Information System
Elementary Schools	Abernethy			19							
	Applegate	55	25								
	Beach	69	65								
	Boise			112	33	32					
	Buckman	108	71								
	Clarendon	55	44								
	George	66	64								
	James John			44	45	21	77				
	Kellogg	114	91								
	Kelly	79	32								
	Markham			37	32	29	204	40			
	Meek	77	5								
	Ockley Green	105	92				429				
	Peninsula	97	82								
	Portsmouth			51	89	35					
	Sellwood	108	91								
	Tubman			140	8	48	184	98	33		
	Whitaker	107	124								
High Schools	Benson						250		37		
	Grant						144	10			yes
	Jefferson						180	35	3		
	Lincoln						100				yes
	Totals	1040	786	405	207	165	1586	183	73		

CHAPTER 1

COMPUTER-ASSISTED INSTRUCTION

INTRODUCTION

Schools in the Portland District used a wide variety of Computer-Assisted Instruction (CAI) during the 1982-83 school year. Evaluation was conducted to investigate the effects of the CAI programs on students' performances. This evaluation of CAI included those elementary/middle schools whose programs were in place before the fall of 1982 and where previous arrangements had been made to collect and manage pre- and post-test data. In addition to on-site observation of program operations, information was collected through interviews with building principals, CAI coordinators, CAI and regular classroom teachers, and instructional aides who participated in CAI programs.

CAI programs included in this evaluation were implemented through the use of microcomputers and the district's minicomputer. The microcomputers used software from Milliken, Radio Shack and Random House. The minicomputer was programmed with Computer Curriculum Corporation (CCC) software. All CAI programs were used to supplement instruction to low-achieving students in either mathematics, reading or language usage. The software curricula themselves are described in Appendix B.

A comparison of CAI gains was used to determine student achievement across the following variables: grade levels, schools, number of years in CAI, total minutes in the CAI program during a school year, supervision of instructional groups and post-treatment instruction.

The Portland Achievement Levels Tests (Grades 5-8) were administered in the fall and spring of the 1981-82 and the 1982-83 school years in order to measure student achievement. In the spring of 1983 participating students completed a survey questionnaire designed to assess their opinions of CAI.

The course content of the CAI programs was matched with the goals of the Portland Achievement Levels Tests to determine the relationship between the supplemental CAI instruction and the testing instrument. This match is displayed in Appendix C.

CHARACTERISTICS OF CAI PROGRAMS

Student Selection

Students were selected for the CAI programs based on Chapter I eligibility requirements (i.e., a P-score of 43 or below and/or teacher judgement).

Grades Served and Number of Students

An unduplicated total of 504 individual students were involved in CAI. The CAI programs served 730 students from six elementary/middle schools including individual participation in more than one curriculum program. The students ranged from grade three to grade eight with 403 students receiving CAI in mathematics, 162 students receiving CAI in reading and 165 students receiving CAI in language usage. Table 2 presents the breakdown of these students by schools.

Table 2

Breakdown of CAI Students by Schools

School	Grades	Total	Reading	Mathematics	Language Usage
Abernethy	3-5	19		19	
Boise	4-8	177	33	112	32
James John	4-8	65		44	21
Markham	6-8	98	32	37	29
Portsmouth	6-8	175	89	51	35
Tubman	6-8	196	8	140	48

Staff Training

Principals in the study schools selected Chapter I teachers or other interested teachers to initiate their CAI programs. Two of the four CAI vendors trained those teachers who were selected to initiate their programs.

All teachers using the Radio Shack software received a half-day in-service and participated in a class at Radio Shack. The CCC teachers participated in a one-day workshop and received two-half day training sessions. Teachers using the Milliken and Random House software participated in district workshops and were university-trained in computer programming. However, formal training in Milliken and Random House software was not provided.

Administrative support for the teachers and the programs took the form of: (1) principals receiving training in computer use and programming; (2) principals participating in the instruction of CAI courses; and (3) schools continuing to develop their CAI programs to support curriculum programs as well as to meet the learning needs of individual students.

Software

Table 3 displays the software and computers used to supplement instruction by schools.

Table 3

CAI Software and Computers Used by Schools

School	Grades	Mini			Micro			
		Math	Read	Lang.	Math	Read	Lang.	Computer
Abernethy	3-5				RS			TRS-80
Boise	4-8		CCC	CCC	CCC			
James John	4-8				RS/RH		RH	TRS-80
Markham	6-8				M	M	M	Apple II
Portsmouth	6-8	CCC	CCC	CCC				
Tubman	6-8	CCC	CCC	CCC	RS			TRS-80

Abbreviations

CCC	Computer Curriculum Corporation
M	Milliken
RS	Radio Shack, K-8 Math
RH	Random House

A description of software curricula is presented in Appendix B.

EFFECTS OF CAI PROGRAMS

Achievement growth was measured by the difference in the fall and spring administrations of the Portland Achievement Levels Tests in mathematics, reading and language usage. The achievement growth of the CAI students in 1982-1983 was compared with their achievement growth in 1981-82 to determine rate of growth from year to year. The results are reported in tables using Deviation scores, GROW indices and RATE indices for clear and intact groups. These are defined as follows:

1. Clear and intact groups include students who had fall and spring test scores for a given year (clear) and were enrolled at the same school in the fall and spring (intact). The Deviation and GROW scores are based on one year clear and intact groups, while RATE scores are based on 2-year clear groups.
2. Deviations are group statistics showing the deviation of a group mean from a mean of all group RIT means in the District. RIT scores are equal interval curriculum-based scores that are obtained from Portland Achievement Levels Tests.
3. GROW is an index that represents the amount of achievement growth in clear and intact groups in a given year. It shows the deviation of groups' fall to spring gain from the mean gains of all grade level groups in the District.
4. RATE is an index that represents the change in the amount of achievement growth in 1982-1983 as compared with 1981-1982. It is also based on a comparison of the difference in means for a group with the differences for all groups at that grade level in the District. It shows the deviation of year to year groups' gain from the mean gains of all grade level groups in the District. For example, a student's scores are included in the RATE interpretation if he has test results for fall and spring of both 1981-82 and 1982-83 and attended a computer-based instruction program in 1982-83. He did not have to attend the same school in both years, nor does the school he attended in 1981-82 have to be a school with computer-based instruction programs.

The criteria for interpreting GROW and RATE indices is presented in Table 4.

Table 4
Criteria for Interpretation of GROW and RATE Values

GROW/RATE Value	Interpretation
-2.0 and below	Negative significant gain
-2.0 to -1.7	Negative gain approaching significance
-1.6 to -.7	Non-significant negative gain
-.7 to .7	No gain or loss
.7 to 1.6	Non-significant positive gain
1.7 to 2.0	Positive gain approaching significance
2.0 and above	Positive significant gain

Only groups of more than 25 students are included in the interpretation due to error associated with statistics based on small sample sizes.

In all comparisons the data include only achievement scores of those students grades 5-8 who were in a CAI program a minimum of .5 years, and at least 300 minutes during the 1982-83 school year.

The data are presented in three sets of tables by CAI subject, number of years of student participation in the program and software. Tables 5, 6, 7 present data for students who received supplemental instruction in mathematics; Tables 8, 9, 10 cover reading; and 11, 12, 13 language usage.

Standard Deviation Means Showing Growth and RATE of Growth for Students Receiving Supplemental Instruction in Mathematics

Table 5
CAI Students Enrolled One Year, 1982-83, by Software

Software	Deviations of Group Means				Growth F to S		RATE of Growth
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	81-82 to 82-83
CCC	-2.63 (75)	-2.34 (75)	-2.41 (91)	-2.30 (91)	.93 (75)	.36 (91)	-.42 (71)
Milliken	-1.83 (21)	-2.12 (21)	-2.43 (22)	-2.18 (22)	-.98 (21)	.81 (22)	1.20 (19)
Radio Shack	-3.39 (64)	-3.20 (64)	-3.75 (83)	-3.71 (83)	.57 (64)	.12 (83)	-.87 (61)
Totals	-2.83 (160)	-2.65 (160)	-2.98 (196)	-2.88 (196)	.54 (160)	.31 (196)	-.40 (151)

Table 6
CAI Students Enrolled One or Two Years, as at 1982-83, by Software

Software	Deviations of Group Means				Growth F to S		RATE of Growth
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	81-82 to 82-83
CCC	-2.60 (103)	-2.21 (103)	-2.40 (127)	-2.25 (127)	1.25 (103)	.18 (127)	-.96 (98)
Milliken	-2.14 (26)	-2.18 (26)	-2.48 (27)	-2.24 (27)	-.13 (26)	.85 (27)	.41 (24)
Radio Shack	-3.48 (71)	-3.23 (71)	-3.74 (93)	-3.72 (93)	.74 (71)	.03 (93)	-1.03 (68)
Totals	-2.85 (200)	-2.57 (200)	-2.86 (247)	-2.80 (247)	.89 (200)	.20 (247)	-.81 (190)

Table 7
CAI Students Enrolled Two Years, 1981-83, by Software

Software	Deviations of Group Means				Growth F to S		RATE of Growth
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	81-82 to 82-83
CCC	-2.52 (28)	1.86 (28)	-2.05 (36)	-2.15 (36)	2.12 (28)	-.28 (36)	-2.37 (27)
Milliken	-3.43 (5)	-2.39 (5)	-2.72 (5)	-2.47 (5)	3.43 (5)	1.03 (5)	-2.58 (5)
Radio Shack	-4.29 (7)	03.56 (7)	-3.68 (10)	-3.79 (10)	2.24 (7)	-.70 (10)	-2.36 (7)
Totals	-2.95 (40)	-2.22 (40)	-2.43 (51)	-2.50 (51)	2.31 (40)	-.23 (51)	-2.39 (39)

Standard Deviation Means Showing Growth and RATE of Growth for Students Receiving Supplemental Instruction in Reading

Table 8
CAI Students Enrolled One Year, 1982-83, by Software

Software Program	Deviations of Group Means				Growth F to S		RATE of Growth
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	81-82 to 82-83
CCC	-2.50 (34)	-2.22 (34)	-1.98 (47)	-2.12 (47)	1.02 (34)	-.42 (47)	-1.55 (41)
Milliken	-2.93 (6)	-3.09 (6)	-2.61 (7)	-2.45 (7)	-.53 (6)	.70 (7)	-.71 (6)
Totals	-2.57 (40)	-2.35 (40)	-2.06 (54)	-2.16 (54)	.79 (40)	-.27 (54)	-1.45 (47)

( ) Indicates number of students involved

Table 9

CAI Students Enrolled One or Two Years, as at 1982-83, by Software

Software Program	Deviations of Group Means				Growth F to S		
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
CCC	-3.22 (58)	-2.77 (58)	-2.58 (75)	-2.54 (75)	1.57 (58)	.30 (75)	-1.19 (78)
Milliken	-2.48 (10)	-2.37 (10)	-2.23 (11)	-1.97 (11)	.39 (10)	1.15 (11)	-.52 (10)
Totals	-3.11 (68)	-2.71 (68)	-2.53 (86)	-2.46 (86)	1.40 (68)	.41 (86)	-1.31 (74)

Table 10

CAI Students Enrolled Two Years, 1981-83, by Software

Software Program	Deviations of Group Means				Growth F to S		
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
CCC	-4.25 (24)	-3.54 (24)	-3.58 (28)	-3.24 (28)	2.36 (24)	1.51 (28)	-.22 (23)
Milliken	-1.8 (4)	1.28 (4)	-1.58 (4)	-1.14 (4)	1.78 (4)	1.93 (4)	-.23 (4)
Totals	-3.90 (28)	-3.21 (28)	-3.33 (32)	-2.98 (32)	2.28 (28)	1.56 (32)	-1.07 (27)

Standard Deviation Means Showing Growth and RATE of Growth for Students Receiving Supplemental Instruction in Language Usage

Table 11

CAI Students Enrolled One Year, 1982-83, by Software

Software	Deviations of Group Means				Growth F to S		
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
CCC	-4.07 (56)	-3.07 (56)	-3.19 (69)	-2.73 (69)	2.15 (56)	2.03 (69)	-.84 (61)
Milliken	-3.63 (9)	-2.06 (9)	-2.79 (11)	-2.50 (11)	4.44 (9)	1.28 (11)	-2.75 (10)
Random House	-2.18 (4)	-2.35 (4)	-3.75 (3)	-4.32 (3)	-.45 (4)	-1.58 (3)	-.60 (3)
Totals	-3.90 (69)	-2.90 (69)	-3.16 (83)	-2.76 (83)	2.30 (69)	1.80 (83)	-1.09 (74)

Table 12
CAI Students Enrolled One or Two Years, as at 1982-83, by Software

Software	Deviations of Group Means				Growth F to S		
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
CCC	-4.22 (63)	-3.19 (63)	-3.41 (77)	-2.88 (77)	2.24 (63)	2.30 (77)	-.79 (68)
Milliken	-3.63 (9)	-2.06 (9)	-2.79 (11)	-2.50 (11)	4.44 (9)	1.28 (11)	-2.75 (10)
Random House	-2.18 (4)	-2.35 (4)	-3.75 (3)	-4.32 (3)	-.45 (4)	-1.58 (3)	-.60 (3)
Totals	-4.40 (76)	-3.01 (76)	-3.35 (91)	-2.88 (91)	2.36 (76)	2.05 (91)	-1.03 (81)

Table 13
CAI Students Enrolled Two Years, 1981-83, by Software

Software	Deviations of Group Means				Growth F to S		
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
CCC	-5.46 (7)	-4.14 (7)	-5.32 (8)	-4.14 (8)	2.97 (7)	4.62 (8)	-.37 (7)
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Totals	-5.46 (7)	-4.14 (7)	-5.32 (8)	-4.14 (8)	2.97 (7)	4.62 (8)	-.37 (7)

The critical figures in these tables are the total RATEs for each subject. These are shown separately in Table 14.

Table 14
RATE of Growth, by Subject and Length of Enrollment

	Mathematics	Reading	Language Usage
One year, 1982-83	- .40	-1.45	-1.09
One or Two Years, as at 1982-83	- .81	-1.31	-1.03
Two Years, 1981-83	-2.39	-1.07	- .37

According to the criteria for the interpretation of RATE, Tables 5-13 indicate that students enrolled for one year in CAI programs for mathematics had no gain or loss, and in reading and language usage had non-significant negative gain in their basic skills achievement. Students enrolled two years in CAI programs showed a negative significant gain in mathematics and a non-significant negative gain in reading. Number of students enrolled in language usage for two years was too small to include in this interpretation. Students enrolled one or two years showed non-significant negative gain in mathematics, reading and language usage.

In addition to considering achievement growth by numbers of years of participation in CAI programs, the evaluation also investigated the relationship between student achievement and three other variables: (1) time in terms of total minutes in the supplemental CAI program during the 1982-83 school year; (2) supervision of CAI instruction; and (3) post-treatment instruction.

Minutes Per Year

CCC software internally recorded each student's total working time in minutes at the computer terminal. The other CAI programs were considered in terms of scheduled time provided students during the 1982-83 school year. A more precise number of minutes each student actually worked with the computer was available for all CCC students at Boise, Portsmouth, Tubman, and for 19 Radio Shack K-8 Math students at Abernethy. A less precise figure was calculated for Milliken at Markham, Random House at James John and Radio Shack K-8 Math at James John and Tubman. Tables 15, 16, 17 present rate of growth by minutes and software.

Table 15
Mathematics Standard Deviation Means Showing RATE of Growth for Students Enrolled One or Two Years, by Software and Minutes

	Minutes				
Software	301-600	601-900	901-1200	1201-1500	1500 +
CCC	-.81 (23)	.08 (31)	-1.72 (37)	-.15 (11)	.92 (3)
Milliken	--	--	.56 (18)	--	-2.58 (5)
Radio Shack	--	-.70 (22)	1.10 (14)	-1.25 (33)	--
Totals	-.81 (3)	-.25 (53)	-1.00 (69)	-.97 (44)	-1.27 (8)

Table 16
Reading Standard Deviation Means Showing RATE of Growth for Students Enrolled One or Two Years, by Software and Minutes

	Minutes				
Software	301-600	601-900	901-1200	1201-1500	1500 +
CCC	-1.68 (13)	1.62 (14)	-2.62 (14)	-1.70 (16)	-4.09 (7)
Milliken	--	--	.27 (2)	--	-.72 (8)
Totals	-1.68 (13)	1.62 (14)	-2.26 (16)	-1.70 (16)	-2.29 (15)

Table 17
Language Usage Standard Deviation Means Showing RATE of Growth for Students Enrolled One or Two Years, by Software and Minutes

	Minutes				
Software	301-600	601-900	901-1200	1201-1500	1500 +
CCC	-.37 (37)	-.23 (24)	-1.76 (6)	.08 (1)	--
Milliken	--	-6.09 (2)	-1.92 (8)	--	--
Random House	--	-2.39 (13)	--	--	--
Totals	-.37 (37)	-1.87 (39)	-1.85 (14)	.08 (1)	--

According to the criteria for the interpretation of RATE (only for groups of greater than 25 students), students enrolled for one or two years in CAI mathematics had results indicating neither gain nor loss when they participated for 601-900 minutes (RATE = -.25, N=53). For math students participating 901-1200 minutes and 1201-1500 minutes, a non-significant negative gain is shown (RATE = -1.00, N=69; RATE = .97, N=44, respectively).

Results for students enrolled one or two years in language usage show neither gain nor loss for students who participated 301-600 minutes per year (RATE = -.37, N=37) and for students who participated 601-900 minutes a negative gain approaching significance resulted (RATE = -1.87, N=39).

The number of minutes students used the computer was correlated with the students' growth in mathematics, reading and language usage and is shown in Table 18. The reason for no relationship in any subject is not readily apparent from these data.

Table 18
Relationship Between Standardized Growth from Fall '82 to Spring '83 and Number of Minutes (300 or more) Student Used the Computer

	Mathematics	Reading	Language Usage
Correlation	-.09	.09	-.01
N	279	103	109

Type of Supervision

The responsibility for student and program supervision during the supplemental CAI program was investigated. Supervisors were either specially assigned certified teachers, classified instructional aides, or the students' regular classroom teachers. No student had more than one type of supervision Table 19 displays RATE of Growth by supervision for mathematics and language usage. No significant differences were found between types of supervision.

Table 19
Standard Deviation Means Showing RATE of Growth for CAI Students Enrolled for One or Two Years by Supervision and Subject

Mathematics Supervision			Language Usage Supervision		
Lab Teacher	Lab Aide	Class Teacher	Lab Teacher	Lab Aide	Class Teacher
-.50 (82)	-.53 (52)	-1.13 (64)	-1.17 (23)	-1.47 (71)	-.94 (27)

In terms of program supervision for CAI mathematics, results show neither gain nor loss when students worked under the direction of a Lab Teacher (RATE = -.50, N=82) or a Lab Aide (RATE = -.53, N=52). A non-significant negative gain resulted for groups whose CAI program supervisor is the regular classroom teacher (RATE = -1.13, N=64). For language usage CAI, non-significant negative gains resulted with all three kinds of supervision: Lab Teacher RATE -1.17, N=23, Lab Aide RATE = -1.47, N=71, Classroom Teacher RATE = -.94, N=27.

Post-Treatment Instruction

The third variable, post-treatment instruction, investigated the extent to which regular classroom teachers used student performance information from the CAI supplemental program in their regular classroom planning and instruction. Student performance information included available printouts on CAI performance, or direct communication about performance between the classroom teacher and the CAI supervisor. Post-treatment instruction effects are presented in Table 20 in three categories: (1) information is used, (2) information is not used, and (3) information may or may not be used.

Table 20
Standard Deviation Means Showing RATE of Growth for CAI Students Enrolled One or Two Years by Post-Instructional Use and Subject

Mathematics: Classroom Teacher			Language Usage: Classroom Teacher		
Classroom Teacher Uses	Classroom Teacher Doesn't Use	Classroom Teacher Might Use	Classroom Teacher Uses	Classroom Teacher Doesn't Use	Classroom Teacher Might Use
-1.14 (63)	-1.54 (26)	-.26 (109)	-1.81 (43)	--	-.79 (47)

When post-treatment instruction for CAI mathematics is considered, a non-significant negative gain results when Classroom Teacher use (RATE = -1.14, N=63) or non-use (RATE -1.54, N=26) is reported. Neither gain nor loss is shown for those groups whose classroom teachers "might" use CAI information (RATE = -.26, N=109). When post-treatment instruction for CAI language usage is considered, a negative gain approaching significance resulted when reports indicated that classroom teachers used information (RATE = -1.81, N=43); and a non-significant negative gain when they "might" have used information (RATE = -.79, N=47). The data indicate that CAI performance information for post-treatment instruction had no significant effect on achievement gains.

Reactions to Computer Use

A short survey of opinions concerning use of the computer was given in CAI classes to 212 students in the spring of 1983. Table 21 shows the questions asked, the number of students answering "yes" or "no" to the questions, and the standard deviation means for each group.

Table 21
Relationship Between 1983 Reading and Mathematics Standard Deviation Means and Student Opinions Regarding Computer Use for CAI Reading and Mathematics

Survey Questions	Reading Deviation Means, Spr 83 Yes	Reading Deviation Means, Spr 83 No	Mathematics Deviation Means, Spr 83 Yes	Mathematics Deviation Means, Spr 83 No
1. Do you like working on the computer more than at your desk?	-2.29 (185)	-1.64 (20)	-2.29 (189)	-1.94 (21)
2. Is the computer easy for you to use?	-2.24 (194)	-2.83 (10)	-2.18 (199)	-3.42 (10)
3. Does the computer make schoolwork easier for you to learn?	-2.22 (173)	-2.52 (34)	-2.28 (175)	-2.22 (36)
4. Do you remember more of what you learn with a computer than with regular classwork?	-2.28 (130)	-2.21 (76)	-2.31 (134)	-2.12 (77)
5. Do you want more class time with a computer?	-2.28 (180)	-2.33 (27)	-2.14 (184)	-3.09 (28)

Because the data indicate that participating students are low achieving overall yet generally favorable toward the use of computers, this information rules out the possibility of negative response to the computer as a tool influencing student learning in a negative direction.

A match of CAI software curricula with Portland Achievement Levels Tests goals is provided in Appendix C. In general, the CAI reading software included fairly complete coverage of the reading goals. Language usage goals were less extensively covered, and there were real gaps in the match between CAI math software and math goals. However, since the CAI programs are supplementary, one would not expect them to provide comprehensive curricular/instructional programs. Students who participated in CAI programs did receive drill and practice experiences in basic skills which were tested on the Portland Achievement Levels Tests. That their achievement gains were not greater does not appear to be due to the content of the CAI curricula.

CONCLUSIONS ABOUT CAI PROGRAMS

The most reasonable conclusion based on these findings is that the CAI programs were not successful supplements to learning as implemented in grades 5 through 8.

The data using students' achievement records from six Portland elementary schools at grades 5 through 8 where the four CAI software curricula were implemented show that student learning in the basic skills has not been improved.

Mean achievement gains for students participating in each of the CAI programs were less than normally expected of groups throughout the District and less than those of other Chapter I groups (excluding the students who were in the Prescription Learning program). Small differences were found between schools and between subjects, but none of the differences are statistically significant at the 5% level.

The data included only students who had more than one semester and more than 300 minutes working time on computers in these software curricula. However, there was no relationship between the number of minutes and achievement gain over the year in any subject.

A survey of the attitudes of students in the CAI programs showed that students liked working on the computer and thought it helped them learn.

For evaluation purposes we judged the computer maintenance and software vendor support to be satisfactory.

The use of these computer-aided learning programs has not made a significant difference in achievement gains.

RECOMMENDATIONS FOR CAI PROGRAMS

Our existing efforts to use computers in the elementary schools are overall a failure. Therefore, in order to move forward to supplement instruction more effectively, other computer-assisted instructional programs should be used and evaluated.

We reiterate the recommendation of the previous year's study, "It is evident that other software, other curriculum or instructional activities, and other scheduling patterns than those used in 1981-82 (and 1982-83) should be tried under carefully-controlled conditions."

We recommended that a concerted effort be made to understand the educational effect of any CAI implementation for students and teachers. This is necessary, first of all, to prevent negative side effects in shaping students' learning processes; and secondly, to determine how best to assist teachers to change instructional practices to make use of the best features of computer-assisted teaching.

The situation is different now from the earlier rush to use the "technology" of tape recorders in rooms full of carrels with earphones, or from the intuitive acceptance of the reading labs with latent image response worksheets. It is different from the hopes for earlier teaching machines sometimes linked with performance contracting, or the programmed learning texts with branching assignments and assistance. The computer is a much more assertive stimulus than movies, film loops, and closed-circuit television. Although most of the enthusiasm for these, as well as the computer-managed instruction systems that interfaced computer and teacher (rather than computer and student) has dimmed harmlessly, the required interface of students' learning processes with the programmed response patterns of a computer is not as benign, psychologically, as the earlier devices which were often also accepted on faith. We need to seriously consider the possibility of undesirable side effects if computers are misused in ignorance of their full impact on students' ways of learning.

We strongly recommend that the Curriculum Department and the Department of Instructional Technology identify high priority questions, such as those which follow, in order to provide theoretical and logistical bases for evaluation.

The following questions represent a larger number of important considerations in recognizing student involvement in the new technology.

Questions for CAI Users

1. Does the Help Request option improve a drill and practice program through: (1) extent of learning; and (2) approach to learning?

2. Can certain uses of computers be identified and shown to improve problem-solving behavior in students?

3. Is there an interaction of chronological age with curriculum and instructional tasks?

4. What effect do successive years in drill and practice programs have on basic skills acquisition?

5. How can educators identify students whose learning is inhibited on the computer and determine the hardware/software effects?

6. In what activities can teacher and computer articulation of time and resources complement or interfere with each other?

7. What should be replaced by the time used to develop "computer expertise" in the elementary school curriculum?

8. What are the relationships among the learning styles of individuals, modes of computer instruction and problem-solving methods and skills?

9. What are the relationships between convergent and divergent thinking and modes of computer instruction?

10. What are the relationships between modes of computer instruction and self-esteem and images of personal efficacy, with particular regard to the special cases of females, ethnic minorities and non-native speakers of English? (This is also of interest in the cases of developmentally disabled and physically disabled individuals.)

If, as recommended, other and more promising computer-related software, curriculum, instructional activities and scheduling patterns are adopted for in-District, in-depth tryout, the Research and Evaluation Department will work with program personnel to develop a research and evaluation design that will both test the effectiveness of those new initiatives and begin to respond to more fundamental questions such as those above.

CHAPTER 2

PRESCRIPTION LEARNING

INTRODUCTION

Prescription Learning is a multi-media diagnostic prescriptive program that provides individualized instruction through the use of six instructional strategies. Eight elementary schools and four middle schools in the Portland School District use Prescription Learning to provide supplemental reading and math instruction to low-performing students.

The diagnostic, prescriptive and instructional procedures used in Prescription Learning were specified by program guidelines and were essentially identical for all schools. Prescription Learning students were administered either the SRA Reading Test or the Plasment Test, which was developed by Prescription Learning, at the beginning of the year. The results provided a Starter Prescription that placed students in the appropriate level in a skill continuum and specified which skills in the continuum the student needed to master. A more detailed Individual Prescription, also based on results from the placement tests, was sent from Prescription Learning Corporation to the schools after about two weeks. Students worked on the Starter Prescription until the Individual Prescription arrived.

The Individual Prescription specified no more than four objectives not yet mastered at the student's skill level and the instructional strategies for each objective. Students received a copy of the prescription and were either directed into an instructional strategy or permitted to choose the instructional strategy with which to start. Students usually completed all instructional strategies in each objective before taking a "hands-on" test which measured those objectives the student had yet to master and objectives not yet tested. Students are considered to have mastered the objective when they correctly answer two of three questions per objective. The results from the "hands-on" test updated the student's Individual Prescription. A fuller description of Prescription Learning is provided in Appendix B.

CHARACTERISTICS OF PRESCRIPTION LEARNING PROGRAMS

Student Selection

Students were selected for the Prescription Learning program based on Chapter I eligibility requirements (i.e., a P-score of 43 or below and/or teacher judgment). Additional criteria were established at five of the schools which had the choice of placing students in either Prescription Learning or other Chapter I activities. Four of the five schools had the choice of placing students in other Chapter I reading activities while one school could place students in other Chapter I reading and math activities. The additional criteria did not change the prerequisite that all students first met Chapter I eligibility requirements.

Grades Served and Number of Students

The Prescription Learning program served students in Grades K-8 with most students in Grades 6-8. A total of 1209 students received services in Prescription Learning: 1040 students in reading and 786 in math (See Table 22).

Table 22
Prescription Learning Schools, Grades
and Number of Students in Each Subject

Schools	Grades	Number of Reading Students	Number of Math Students	Total Number of Students (Unduplicated)
Applegate	1-5	55	25	74
Beach	K-5	69	65	93
Buckman	2-8	108	71	121
Clarendon	1-4	55	44	60
George	4-7	66	64	66
Kellogg	6-8	114	91	119
Kelly	2-8	79	32	109
Meek	2-5	77	5	80
Ockley Green	6-8	105	92	113
Peninsula	1-8	97	82	100
Sellwood	5-8	108	91	139
Whitaker	7-8	107	124	135
Total		1040	786	1209

*A total of 149 students were served in the Whitaker Prescription Learning: 125 students in reading and 125 in mathematics. Some students attended the PL reading program for only one or two quarters because they also received instruction in the Educational Developmental Laboratory (EDL). These students are not included in Table 22 nor are their scores included in the achievement data. Only students who were in Prescription Learning and who were not in EDL are included in Table 22 and achievement data.

**The results for Peninsula School were not included in the data interpretation because it is a year-round school and the number of days between the pre-test and the post-test were not the same as the other schools.

Staff

Each school's Prescription Learning program was staffed by at least one teacher. Table 23 shows the number and FTE of teachers and aides per school.

Table 23

Number and FTE of Teachers
and Aides in Prescription Learning Schools

School	Teacher		Aides	
	Number	FTE	Number	FTE*
Applegate	2	1.0	--	--
Beach	1	1.0	1	0.25
Buckman	1	1.0	1	0.5
Clarendon	2	1.0	--	--
George	1	.5	1	0.5
Kellogg	1	1.0	2	0.7
Kelly	1	1.0	2	0.6
Meek	1	0.5	1	0.5
Ockley Green	1	1.0	1	0.5
Peninsula	1	1.0	1	0.5
Sellwood	1	1.0	2	1.0
Whitaker	1	1.0	2	0.75

*The formula used to determine Aide FTE is 7 hours = .5 FTE

Training

The Prescription Learning Corporation in 1982-83 provided for new teachers and aides at the beginning of the school year a one day general training session followed by a one day on-site training session. In addition, teachers and staff attended a workshop provided by the Prescription Learning Corporation as specified in the contract. During the year, the Area Director or Technical Consultant from Prescription Learning Corporation made on-site visitations every other week to review diagnostic and prescriptive procedures and answer questions. A special meeting was held at the beginning of the year to review possible program improvements after a training consultant from Prescription Learning visited each program.

Eight of the nine* new teachers/coordinators received initial training at the beginning of the year. Five of the eight attended both the general training session and on-site training session while three attended only the on-site training session. Generally, aides also attended the training sessions. Those who did not were trained by their respective teachers.

Equipment

Prescription Learning programs used a variety of instructional media equipment as part of their teaching strategies. Table 24 shows the type and number of instructional equipment used at each school. A total of 48 PET Commodore computers were used (15 8K, 18 16K and 15 32K) with either a single and/or dual disk drive accompanied by a printer. In addition, most schools had one or more each of Dukane readers, Hoffman readers, card readers and tape players.

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*One teacher was unable to attend the initial training session and received training on the job and from on-site visitations.

Table 24
Equipment in Prescription Learning Schools

School	Commodore Pets 8K	16K	32K	Disk Drive Single	Dual	Printer	Dukane Reader	Hoffman Reader	Card Reader	Tape Player
Applegate		1	4	1	1	1	2	1	1	2
Beach		3	1	1	1	1	2	1	1	2
Buckman		3	1	1	1	1	2	2	1	2
Clarendon		2	1	1	1	1	2	2	1	2
George	3	2	1	1	1	1	2		2	3
Kellogg	3		1		1	1	3	1	2	2
Kelly		2	1	1	1	1	2	2	1	2
Meek		2	1	1	1	1	2	1	1	2
Ockley Green	3		1		1	1	3		1	4
Peninsula		3	1	1	1	1	2	1	1	2
Sellwood	3		1		1	1	3		2	4
Whitaker	3		1		1	1	3		2	3
Total	15	18	15	8	12	12	28	11	16	30

Use of Media Stations

According to Prescription Learning guidelines, students should spend an equal amount of time in each instructional strategy. Out of the twelve schools in the evaluation, seven used the six instructional strategies equally, three assigned students to instructional strategies based on the students' individual prescriptions (but still used all six strategies), while two did not use the instructional strategies equally and did not use one or more of the six strategies. One of the two schools which did not use one or more of the instructional strategies did not provide teacher-directed instruction. All of the schools included computer use among their instructional strategies.

Parent Component

In addition to the six instructional strategies, Prescription Learning also had a parent component that consisted of a set of take-home books for students to work on under parental supervision. Of the twelve schools, eight used the books to a limited extent, two did not use them at all, one used the books in the lab as independent study, and one, which graded students for Prescription Learning, required students to use the books at home in order to receive an "A" for the course.

Motivational Strategies

Schools were surveyed to determine if the program employed a motivational strategy. Many staff claimed Prescription Learning is motivational in itself since students are excited to work on the different machines, especially the computer. Beyond the motivation inherent in the program, eight schools established some kind of individual motivational system usually consisting of small prizes and awards (e.g., stickers, computer time, letters to parents, etc.). One school established a reward for all students in the program and three schools did not employ a motivational strategy.

EFFECTS OF PRESCRIPTION LEARNING PROGRAM

The evaluation conducted to investigate the effects of the Prescription Learning program compared the achievement gains of Chapter I students who were in the Prescription Learning program with two different populations: (1) District Chapter I students; and (2) all District students. Next, the achievement growth of Prescription Learning students in 1982-83 was compared with their achievement growth in 1981-82. Student achievement was measured by the results of the Comprehensive Test of Basic Skills, Form S, Primary B and C (Grade 2), and the Portland Achievement Levels Tests (Grades 3-8) in fall and spring of 1982-83.

The District Chapter I program administers the Comprehensive Test of Basic Skills to Grade 2 students for evaluation purposes because the Portland Achievement Levels Tests are not administered below Grade 3. Primary B is administered in the fall and schools are given a choice of administering either Primary B and/or C in the spring depending upon their students' achievement levels.

The evaluation also investigated the relationship between student achievement and two variables: weeks in the program and minutes per week in the program. The results are presented according to the following sections: Grade 2; Grades 3-8; and relationships between student achievement and the two variables.

Grade 2

Table 25 shows the pre- and post-test means and gains for Prescription Learning and District Chapter I students in Grade 2.[1] Scores for non-Prescription Learning students were excluded due to small sample size (N = 7). Data were available from six Prescription Learning schools and thirty-four District Chapter I schools. All scores are based on matched fall/spring scores. Results are expressed in terms of expanded scale score means and corresponding percentiles.

Table 25

Grade 2
Fall 1982, and Spring 1983, Expanded Scale Score and Percentiles for Prescription Learning, non-Prescription Learning, and District/Chapter I Students

Score		Fall	Spring	Gain
Expanded Scale Score	Prescription Learning	262 (71)	298 (71)	36
	Non-Prescription Learning	- (7)	- (7)	-
	District/Chapter I	265 (545)	305 (545)	40
Percentile	Prescription Learning	24.7 (71)	32.5 (71)	7.8
	Non-Prescription Learning	- (7)	- (7)	-
	District/Chapter I	26.6 (545)	36.8 (545)	10.2

The results indicate that although Grade 2 Prescription Learning students made numerically less than District Chapter I students, the difference is too small to be considered other than zero. A comparison of the gains made by Prescription Learning and non-Prescription Learning students was not made because of the small number of the latter students.

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[1] Results in Table 25 reflect totals for students who took Primary B in fall and spring and for students who took Primary B in fall and C in spring. The process for converting the scores for students who took Primary B in fall and spring to in-level scores was to determine their expanded scale score based on their raw score mean and convert it to the corresponding raw score on Primary C. Percentiles were then determined based on the average raw score.

Grades 3-8

Student achievement was measured by fall and spring results of the Portland Achievement Levels Tests in mathematics, reading and language usage. Data were included for students from twelve Prescription Learning schools who were in the program a minimum of 16 weeks. This represents half of the time between the beginning of school to the post-test date. Results for students in the program for less than 16 weeks are not included in the tables but they are mentioned in this section of the report.

The results presented in Tables 26, 27 and 28 show math, reading and language usage data respectively. The math data are for students who received math instruction and the reading and language usage results are for students who received reading instruction in Prescription Learning. Most students received both reading and math instruction. All tables show clear and intact group means for Prescription Learning students for 1981-1982 and 1982-1983 by grade. In addition, the tables show the total group means of students summed across grades for each group, thus producing an overall program total. Results for Chapter I students are presented as a comparison group.

The results are reported in deviation scores, GROW and RATE scores for clear and intact groups. These terms are defined in Chapter 1, page 9.

Table 26
Math Standard Deviation Means for One Year, Two Year, and Total Prescription Learning Students by Grade

		Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Grade 3								
Pres. Learning:	One Year	-2.98 (31)	-2.45 (31)	-3.06 (44)	-1.85 (44)	0.95 (31)	2.40 (44)	--
	Two Year	--	--	--	--	--	--	--
	Total	-2.98 (31)	-2.45 (31)	-3.06 (44)	-1.85 (44)	0.95 (31)	2.40 (44)	--
Chapter I		--	--	--	--	0.40	0.50	-1.41 (3)
Grade 4								
Pres. Learning:	One Year	-2.15 (19)	-2.74 (19)	-2.51 (41)	-2.89 (41)	-1.58 (19)	0.89 (41)	-2.26 (29)
	Two Year	-3.50 (3)	-2.65 (3)	--	--	2.24 (3)	--	--
	Total	-2.33 (22)	-2.73 (22)	-2.51 (41)	-2.89 (41)	-1.07 (22)	-0.89 (41)	-2.26 (29)
Chapter I		--	--	--	--	0.10	0.39	0.51 (151)
Grade 5								
Pres. Learning:	One Year	-3.26 (46)	-3.00 (46)	-3.56 (26)	-3.15 (26)	0.80 (46)	0.94 (26)	1.94 (20)
	Two Year	-2.82 (5)	-2.64 (5)	-4.12 (4)	-3.20 (4)	0.56 (5)	2.13 (4)	1.61 (3)
	Total	-3.22 (51)	-2.96 (51)	-3.63 (30)	-3.16 (30)	0.78 (51)	1.10 (30)	1.90 (23)
Chapter I		--	--	--	--	0.52	1.27	0.19 (183)
Grade 6								
Pres. Learning:	One Year	-3.42 (34)	-3.54 (34)	-3.26 (52)	-3.08 (52)	-0.37 (34)	0.56 (52)	-0.07 (44)
	Two Year	-2.92 (44)	-3.19 (44)	-3.24 (4)	-3.26 (4)	-0.82 (44)	-0.05 (4)	0.28 (4)
	Total	-3.14 (78)	-3.34 (78)	-3.26 (56)	-3.09 (56)	-0.63 (78)	0.51 (56)	-0.04 (48)
Chapter I		--	--	--	--	0.33	0.43	0.35 (174)
Grade 7								
Pres. Learning:	One Year	-3.36 (16)	-3.29 (16)	-3.13 (51)	-2.83 (51)	0.23 (16)	1.55 (51)	1.17 (31)
	Two Year	-3.90 (49)	-3.53 (49)	-3.30 (49)	-2.72 (49)	1.19 (49)	2.94 (49)	1.84 (41)
	Total	-3.76 (65)	-3.47 (65)	-3.21 (100)	-2.78 (100)	0.96 (65)	2.23 (100)	1.55 (72)
Chapter I		--	--	--	--	0.35	0.73	-0.18 (116)

Table 26 (continued)

		Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Grade 8								
Pres. Learning:	One Year	-4.84 (1)	-4.47 (1)	-3.41 (27)	-2.83 (27)	4.98 (1)	2.39 (27)	1.58 (16)
	Two Year	--	--	-3.68 (48)	-3.63 (48)	--	0.24 (48)	-1.07 (45)
	Total	-4.84 (1)	-4.47 (1)	-3.59 (75)	-3.34 (75)	4.98 (1)	1.01 (75)	-0.37 (61)
Chapter I		--	--	--	--	0.88	0.72	-0.59 (102)
All Grades								
Pres. Learning:	One Year	-3.11 (147)	-3.01 (147)	-3.12 (241)	-2.75 (241)	0.22 (147)	1.11 (241)	0.23 (140)
	Two Year	-3.41 (101)	-3.31 (101)	-3.50 (105)	-3.18 (105)	0.32 (101)	1.56 (105)	0.36 (93)
	Total	-3.23 (248)	-3.14 (248)	-3.23 (346)	-2.88 (346)	0.26 (248)	1.24 (346)	0.28 (233)
Chapter I		--	--	--	--	0.40	0.66	0.12 (729)

Table 27
Reading Standard Deviation Means for One Year, Two Year, and Total Prescription Learning Students by Grade

		Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Grade 3								
Pres. Learning:	One Year	-2.76	-2.93	-2.81	-1.78	-0.52	2.66	0.01
		(51)	(51)	(65)	(65)	(51)	(65)	(11)
	Two Year	--	--	--	--	--	--	--
	Total	-2.76	-2.93	-2.81	-1.78	-0.52	2.66	0.01
		(51)	(51)	(65)	(65)	(51)	(65)	(11)
Chapter I		-3.70	-3.67	-2.66	-2.44	0.05	0.55	-0.04
		(4)	(4)	(406)	(406)	(4)	(406)	(115)
Grade 4								
Pres. Learning:	One Year	-2.41	-2.76	-3.00	-2.83	-1.08	0.49	0.43
		(45)	(45)	(69)	(69)	(45)	(69)	(52)
	Two Year	-2.34	-1.25	--	--	3.38	--	--
		(3)	(3)			(3)		
	Total	-2.41	-2.67	-3.00	-2.83	-0.80	0.49	0.43
		(48)	(48)	(69)	(69)	(48)	(69)	(52)
Chapter I		-2.88	-2.58	-2.78	-2.62	0.86	0.47	-0.20
		(224)	(224)	(288)	(288)	(224)	(288)	(256)
Grade 5								
Pres. Learning:	One Year	-2.99	-2.94	-2.96	-3.00	0.08	-0.15	0.54
		(57)	(57)	(53)	(53)	(57)	(53)	(49)
	Two Year	-3.57	-3.32	-4.10	-3.18	0.08	3.17	-1.60
		(11)	(11)	(4)	(4)	(11)	(4)	(3)
	Total	-3.08	-3.00	-3.04	-3.01	0.08	0.08	0.41
		(68)	(68)	(57)	(57)	(68)	(57)	(52)
Chapter I		-2.98	-2.83	-2.91	-2.70	0.52	0.73	-0.03
		(220)	(220)	(243)	(243)	(220)	(243)	(231)
Grade 6								
Pres. Learning:	One Year	-3.22	-3.58	-3.59	-3.31	-1.08	1.11	0.95
		(45)	(45)	(68)	(68)	(45)	(68)	(61)
	Two Year	-3.37	-3.64	-3.66	-2.77	-0.69	3.55	2.56
		(46)	(46)	(10)	(10)	(46)	(10)	(10)
	Total	-3.30	-3.61	-3.60	-3.24	-0.88	1.42	1.17
		(91)	(91)	(78)	(78)	(91)	(78)	(71)
Chapter I		-3.28	-3.05	-2.97	-2.86	0.71	0.46	-0.25
		(175)	(175)	(210)	(210)	(175)	(210)	(190)
Grade 7								
Pres. Learning:	One Year	-3.06	-3.33	-2.84	-2.88	-1.17	-0.20	-0.13
		(26)	(26)	(70)	(70)	(26)	(70)	(55)
	Two Year	-3.57	-3.49	-3.25	-3.06	0.25	0.83	2.00
		(40)	(40)	(57)	(57)	(40)	(57)	(44)
	Total	-3.37	-3.43	-3.02	-2.96	-0.32	0.26	0.96
		(66)	(66)	(127)	(127)	(66)	(127)	(99)
Chapter I		-3.31	-3.04	-2.69	-2.62	0.94	0.32	-0.36
		(138)	(138)	(160)	(160)	(138)	(160)	(141)

Table 27 (continued)

		Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Grade 8								
Pres. Learning:	One Year	-3.45 (1)	-5.10 (1)	-2.80 (36)	-2.95 (36)	-2.00 (1)	-0.61 (36)	0.60 (34)
	Two Year	--	--	-3.06 (42)	-3.48 (42)	--	-1.80 (42)	-1.34 (40)
	Total	-3.45 (1)	-5.10 (1)	-2.94 (78)	-3.24 (78)	-2.00 (1)	-1.25 (78)	-0.45 (74)
Chapter I		-3.14 (115)	-3.00 (115)	-2.88 (154)	-2.92 (154)	0.61 (115)	-0.08 (154)	-0.23 (131)
All Grades								
Pres. Learning:	One Year	-2.88 (225)	-3.09 (225)	-3.02 (361)	-2.78 (361)	-0.68 (225)	0.66 (361)	0.51 (262)
	Two Year	-3.44 (100)	-3.47 (100)	-3.25 (113)	-3.19 (113)	-0.11 (100)	0.18 (113)	0.57 (97)
	Total	-3.05 (325)	-3.21 (325)	-3.07 (474)	-2.88 (474)	-0.50 (325)	0.55 (474)	0.53 (359)
Chapter I		-3.09 (876)	-2.87 (876)	-2.80 (1461)	-2.65 (1461)	0.72 (876)	0.46 (1461)	-0.18 (1064)

Table 28
Language Usage Standard Deviation Means for One Year,
Two Year, and Total Prescription Learning Students by Grade

		Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Grade 3								
Pres. Learning:	One Year	-2.78 (57)	-3.20 (57)	-2.89 (67)	-1.94 (67)	-1.06 (57)	2.61 (67)	0.01 (9)
	Two Year	--	--	--	--	--	--	--
	Total	-2.78 (57)	-3.20 (57)	-2.89 (67)	-1.94 (67)	-1.06 (57)	2.61 (67)	0.01 (9)
Chapter I		-1.97 (2)	-2.64 (2)	-2.38 (84)	-2.64 (84)		-0.70 (84)	0.27 (34)
Grade 4								
Pres. Learning:	One Year	-2.38 (46)	-2.15 (46)	-3.10 (70)	-2.45 (70)	0.72 (46)	1.88 (70)	2.71 (52)
	Two Year	-1.98 (3)	-3.10 (3)	--	--	-3.16 (3)	--	--
	Total	-2.36 (49)	-2.21 (49)	-3.10 (70)	-2.45 (70)	0.48 (49)	1.88 (70)	2.71 (52)
Chapter I		-2.74 (72)	-2.95 (72)	-2.88 (88)	-2.40 (88)		1.45 (88)	1.67 (82)
Grade 5								
Pres. Learning:	One Year	-3.08 (55)	-2.91 (55)	-3.12 (55)	-2.93 (55)	0.46 (55)	0.58 (55)	-0.64 (53)
	Two Year	-2.52 (9)	-2.49 (9)	-5.12 (4)	-3.17 (4)	0.08 (4)	5.58 (4)	6.29 (3)
	Total	-2.99 (64)	-2.85 (64)	-3.26 (59)	-2.95 (59)	0.41 (64)	0.92 (59)	-0.27 (56)
Chapter I		-3.23 (62)	-2.66 (62)	-3.14 (60)	-2.37 (60)		2.25 (60)	0.10 (62)
Grade 6								
Pres. Learning:	One Year	-3.23 (40)	-3.07 (40)	-3.51 (66)	-3.07 (66)	0.38 (40)	1.91 (66)	0.72 (67)
	Two Year	-4.16 (45)	-3.27 (45)	-3.72 (10)	-3.04 (10)	2.12 (45)	2.89 (10)	1.78 (9)
	Total	-3.72 (85)	-3.17 (85)	-3.54 (76)	-3.06 (76)	1.30 (85)	2.04 (76)	0.85 (76)
Chapter I		-3.15 (82)	-2.88 (82)	-3.11 (90)	-2.97 (90)		0.66 (90)	-0.05 (92)
Grade 7								
Pres. Learning:	One Year	-3.54 (26)	-2.84 (26)	-3.37 (70)	-3.03 (70)	1.45 (26)	1.30 (70)	0.05 (50)
	Two Year	-4.27 (42)	-3.15 (42)	-3.81 (55)	-3.33 (55)	2.32 (42)	1.89 (55)	-0.88 (47)
	Total	-3.99 (68)	-3.03 (68)	-3.56 (125)	-3.16 (125)	1.99 (68)	1.56 (125)	-0.40 (95)
Chapter I		-3.33 (72)	-2.39 (72)	-2.66 (79)	-2.39 (79)		1.07 (79)	-1.05 (76)

Table 28 (continued)

		Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Grade 8								
Pres. Learning:	One Year	-2.35	-2.48	-3.03	-2.80	0.11	0.90	-0.47
		(1)	(1)	(36)	(36)	(1)	(36)	(34)
	Two Year	--	--	-2.99	-3.28	--	-1.14	-2.96
				(39)	(39)		(39)	(38)
	Total	-2.35	-2.48	-3.01	-3.05	0.11	-0.16	-1.78
		(1)	(1)	(75)	(75)	(1)	(75)	(72)
Chapter I		-3.53	-2.21	-2.61	-2.46		0.66	-1.80
		(64)	(64)	(77)	(77)		(77)	(74)
All Grades								
Pres. Learning:	One Year	-2.94	-2.85	-3.18	-2.69	0.23	1.62	0.54
		(225)	(225)	(364)	(364)	(225)	(364)	(265)
	Two Year	-3.99	-3.14	-3.55	-3.28	1.86	1.02	-1.23
		(99)	(99)	(108)	(108)	(99)	(108)	(97)
	Total	-3.26	-2.94	-3.27	-2.82	0.73	1.48	0.06
		(324)	(324)	(472)	(472)	(324)	(472)	(362)
Chapter I		-3.18	-2.64	-2.79	-2.55		0.83	-0.16
		(354)	(354)	(478)	(478)		(478)	(420)

The Grade 3-8 results are presented in three sections: deviation means, GROW and RATE. The results are:

Fall and Spring Deviation Means: Overall, the deviation means of all groups in Tables 26, 27 and 28 show Prescription Learning (one year, two year and total) and Chapter I students tend to be the lower-performing students in 1981-1982 and 1982-1983.

GROW: As mentioned previously, GROW represents the standardized amount of growth in a given year. The 1982-83 results show students who were in the program for one year showed non-significant positive gains in mathematics and language usage and no gain or loss in reading. Two-year students had non-significant positive gains in mathematics and language usage and no gain or loss in reading. Similar results are shown when data from one-year and two-year Prescription Learning students are combined. Chapter I students show no gain or loss in math and reading and a non-significant positive gain in language arts and their gains are smaller than those of Prescription Learning students.

RATE: The changes in the RATE of Growth from one year to the next are shown in Table 29; the results for students who were in the program one year show no gain or loss in the RATE of Growth in all three subjects; two-year students show no gain or loss in the RATE of Growth in math and reading and a non-significant negative gain in language usage. When one-year and two-year Prescription Learning students are combined, the total population shows no gain or loss in RATE of Growth from one year to the next in all three subjects. Chapter I students show also no gain or loss in RATE of Growth in all three subjects and their gains are smaller than those of Prescription Learning students.

Table 29
RATE of Growth for Prescription Learning,
by Subject and Length of Enrollment,
Compared to Other Chapter I Programs

Prescription Learning	Mathematics	Reading	Language Usage
One Year, 1982-83	.23	.51	.54
One or Two Years, as at 1982-83	.28	.53	.06
Two Years, 1981-83	.36	.57	-1.23
Chapter I			
One or Two Years, as at 1982-83	.12	-.18	-.16

Other Chapter I Programs

Results for Prescription Learning students, regardless of time in the program (although not shown), were calculated. These results include data from students who were in Prescription Learning less than 16 weeks as well as more than 16 weeks. As a group their results represent a more equivalent comparison to District Chapter I results for students who were included regardless of time. When the results for Prescription Learning, regardless of time, were calculated, overall results for students receiving either math, reading and/or language usage were essentially unchanged. Thus, the exclusion of data for students in Prescription Learning less than 16 weeks does not affect the comparisons with District Chapter I data.

Comparisons Between First- and Second-Year Schools

The results indicate an additional year's experience with the program did not produce larger gains. In order to determine if experience with the program might enable schools to produce larger gains, comparisons were made, although not shown, between schools with one year of experience with Prescription Learning and those with two years of experience. Only students who were in the program for their first year in the second-year schools were compared with students in the first-year schools. Data were available for five second-year schools and seven first-year schools. The results show that students in second-year schools made gains from one year to the next equivalent to first year schools in reading (RATE=.46) and language usage (RATE=.52), and smaller numerically than first-year students in math (RATE=.10), but interpreted as equivalent.

The evaluation also investigated the relationship between student achievement and two other variables: weeks in the program and minutes per week in the program.

Weeks in the Program

Correlations were made between weeks in the program and math and reading gain in 1982-83*. The results indicated no significant correlation (r = -.02) between weeks in the math program and math gain and no significant correlation (r = .00) between weeks in the reading program and reading gain.

Students were then divided into three groups (16-22 weeks, 23-27 weeks, 28-31 weeks) to determine if students enrolled in Prescription Learning for longer periods had larger gains than students in for shorter periods. Table 30 shows the mathematics, reading and language usage standard deviation means for Prescription Learning students for the last two years by weeks. Overall, the results for 1982-83 show students who were in the math program for 23-27 weeks had larger gains than students enrolled for the longer or shorter intervals; similar results were found in reading and in language usage.

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*A correlation was not performed between weeks in the program and language usage gain.

Table 30

Math, Reading and Language Usage Standard Deviation Means for Prescription Learning Students by Weeks

School	Fall 81	Spring 82	Fall 81	Spring 82	GROW 81-82	GROW 82-83	RATE
Math							
16-22	-3.05	-3.16	-3.00	-2.89	-0.27	0.43	0.40
	(54)	(54)	(64)	(64)	(54)	(64)	(51)
23-27	-2.71	-2.76	-3.08	-2.26	0.06	2.08	0.93
	(44)	(44)	(98)	(98)	(44)	(98)	(43)
28-31	-3.46	-3.25	-3.42	-3.22	0.52	1.12	0.08
	(149)	(149)	(182)	(182)	(149)	(182)	(140)
Reading							
16-22	-2.75	-3.14	-2.73	-2.65	-1.33	0.09	0.66
	(70)	(70)	(98)	(98)	(70)	(98)	(82)
23-27	-2.38	-2.64	-2.82	-2.40	-0.90	1.06	0.56
	(68)	(68)	(146)	(146)	(68)	(146)	(88)
28-31	-3.41	-3.43	-3.38	-3.28	-0.05	0.42	0.45
	(187)	(187)	(230)	(230)	(187)	(230)	(189)
Language Usage							
16-22	-3.05	-3.01	-2.89	-2.67	0.09	0.72	0.47
	(70)	(70)	(95)	(95)	(70)	(95)	(81)
23-27	-2.63	-2.27	-2.95	-2.26	0.87	2.04	-0.06
	(71)	(71)	(147)	(147)	(71)	(147)	(92)
28-31	-3.58	-3.17	-3.63	-3.25	0.92	1.43	-0.05
	(183)	(183)	(230)	(230)	(183)	(230)	(189)

Examination of the data revealed a possible explanation for the apparent lack of relationship between weeks in the program and either math or reading gain. The data show each school is not equally represented among the time intervals. In fact, all students in math enrolled for the longer duration and a majority of students in reading were from schools operating for the second year, while most of the students in the shorter duration were from schools operating for their first year. The reason for this difference is probably that the two-year schools were ready to start their programs earlier than one-year schools. Therefore, no defensible statement can be made about the relationship between time and either math or reading gain because each school is not equally represented in each time interval making it difficult to rule out school effect.

Minutes per Week

Correlations were also made between minutes per week and math and reading gain in 1982-83.* Table 31 shows the deviation means for Prescription Learning students for the last two years in math, reading and language usage summed across grades by minutes per week. The correlation indicated no significant correlation (r = -.07) between minutes per week and math gain and no significant correlation (r = .00) between minutes per week and reading gain.

Students were then divided into four groups (00-74 minutes, 75-124 minutes, 125-174 minutes, and 175-225 minutes) to determine if students who received more minutes of instruction per week had larger gains than students who received fewer minutes of instruction.

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*A correlation was not conducted between minutes per week in the program and language usage gain.

Table 31

Math, Reading and Language Usage Standard Deviation Means for Prescription Learning Students by Minutes per Week

Subject	Fall 81	Spring 82	Fall 81	Spring 82	GROW 81-82	GROW 82-83	RATE
Mathematics							
00-74	-3.19	-3.25	-3.43	-2.56	-0.17	2.11	1.19
	(20)	(20)	(39)	(39)	(20)	(39)	(21)
75-124	-3.26	-3.15	-3.19	-2.89	0.26	1.31	0.45
	(185)	(185)	(240)	(240)	(185)	(240)	(171)
125-174	-2.80	-3.11	-3.09	-2.64	-0.75	1.08	1.21
	(8)	(8)	(18)	(18)	(8)	(18)	(8)
175-240	-3.22	-2.98	-3.33	-3.16	0.77	0.45	-0.48
	(35)	(35)	(49)	(49)	(35)	(49)	(35)
Reading							
00-74	-3.53	-3.71	-2.83	-2.87	-0.59	-0.37	-0.63
	(15)	(15)	(36)	(36)	(15)	(36)	(30)
75-124	-3.17	-3.31	-3.18	-2.89	-0.41	0.75	0.51
	(144)	(144)	(208)	(208)	(144)	(208)	(149)
125-174	-2.78	-3.05	-2.82	-2.62	-0.95	0.66	1.00
	(102)	(102)	(143)	(143)	(102)	(143)	(104)
175-240	-3.11	-3.09	-3.35	-3.27	0.03	0.26	0.37
	(64)	(64)	(87)	(87)	(64)	(87)	(76)
Language Usage							
00-74	-3.74	-3.43	-3.24	-2.71	0.59	1.99	0.07
	(17)	(17)	(35)	(35)	(17)	(35)	(27)
75-124	-3.42	-3.16	-3.35	-2.67	0.51	2.17	0.52
	(146)	(146)	(206)	(206)	(146)	(206)	(151)
125-174	-2.87	-2.67	-2.99	-2.80	0.54	0.69	-0.09
	(97)	(97)	(144)	(144)	(97)	(144)	(102)
175-240	-3.36	-2.70	-3.55	-3.27	1.55	0.96	-0.59
	(64)	(64)	(87)	(87)	(64)	(87)	(82)

Overall, the deviations in Table 31 show students in mathematics receiving 00-74 and 75-124 minutes per week made larger gains than students receiving more minutes. Students in the reading program for 75-124 and 125-174 minutes had larger gains than students in for shorter or longer periods per week. In language usage, there were mixed results although students receiving 00-74 and 75-124 made larger gains than students receiving more minutes.

Further investigation of the data revealed a possible explanation for the apparent lack of relationship between minutes per week in the program and mathematics, reading or language usage gain. Data were examined by school and by time interval. The number of students per school were not equally represented among the minute per-week intervals. In fact, almost all students at each school were in one interval while the other two intervals had only a few students. Thus, it is not clear if the results reflect a time effect or an interaction with school differences.

CONCLUSIONS ABOUT PRESCRIPTION LEARNING PROGRAM

The data from students' achievement records in twelve schools where Prescription Learning was used in grades 2-8 for Chapter I students shows that learning in the basic skills improved more with Prescription Learning than with an average of the other supplementary programs used in Chapter I schools, but not to a significant degree.

Students in their second year using Prescription Learning did no better or worse than they had the first year in the program and the students new to Prescription Learning in 1982-83 did no better or worse than the students new to the program in 1981-82. This indicates that program effectiveness did not improve with a year's experience by the District in its implementation.

Only students having more than 15 weeks in the program provided data for these findings.

The Prescription Learning program objectives match the Portland Achievement Levels Tests reading goals fairly well, but coverage in mathematics and language usage is not sufficient to provide a complete supplementary instructional program.

For this evaluation, computer maintenance and services provided by the vendor were judged to be satisfactory.

The most reasonable conclusion based on these findings is that Prescription Learning compares favorably with other Chapter I supplementary programs but is not significantly better.

RECOMENDATIONS FOR PRESCRIPTION LEARNING PROGRAM

Recommendations for Prescription Learning are based on two considerations: (1) level of effectiveness in promoting learning of basic skills; and (2) correspondence of goal coverage and emphasis with the Portland curriculum. Based on the findings of this study it is recommended the program not be cut back or expanded, but that it be continued for another year with the inclusion of instructional materials, especially in mathematics and language usage more closely related to Portland goals.

The vendor has offered to extend the Prescription Learning curriculum to include the functions it does not now teach and in that way match Portland goals. Because there is a probability of increasing student achievement on the Portland Achievement Levels Tests, strengthening the program in this way is worth testing.

Since the District has invested personnel time and purchased materials and equipment to establish the program in Portland, it is recommended that efforts be made to determine how the program mechanics, the selection of materials, inservice for teachers, involvement of students, or whatever other components identified can be improved or changed so that Prescription Learning can reach the level of effectiveness hoped for when it was adopted.

CHAPTER 3

COMPUTER LITERACY PROGRAMS

INTRODUCTION

At the present time, the science-based information industry accounts for greater than one half of our gross national product. This verifies the fact that the United States is no longer in the industrial revolution, but rather in the information revolution. Economists are predicting the raw material of the future will be a computer-literate populace.

As a result, education is being asked to consider computer literacy a part of the curriculum. The National Council of Teachers of Mathematics is asking school districts to add computer literacy to their basic skills requirements. At the present time, 55% of the secondary schools in the United States have access to computers. Yet, large numbers of students never come in contact with computers in the classroom. With trained teachers being the key to computer literacy, it is important to note that at the present time only five states have teacher certification in computer science.

In the Portland School District, goals and objectives for computer literacy have been defined since 1980 within the Computer Science Scope and Sequence. In the past three years many schools in the district have initiated their own computer literacy programs using these objectives and other materials as a guide. One of the aims of this evaluation is to survey the current computer literacy programs in terms of software, computer language, course content and teacher preparation.

CHARACTERISTICS OF COMPUTER LITERACY PROGRAMS

Student Selection

As shown in Table 32, students from four high schools, three middle schools, and one elementary school received instruction in computer literacy. In two of the high schools computer literacy programs were offered as an elective with one of these high schools requiring geometry as a prerequisite. The other two high schools required computer literacy as a condition for graduation; one school required all sophomores to take computer literacy and the other had Math 1-2 as a prerequisite. Two middle schools and one elementary school offered computer literacy programs as electives, and one middle school required computer literacy as a part of the language usage program.

Table 32
Computer Literacy Programs Within Schools

School	Prerequisite	Required	Elective
High School			
Benson	none	X	
Grant	none		X
Jefferson	Math 1-2	X	
Lincoln	geometry		X
Middle			
Markham	none		X
Ockley Green	none	X	
Tubman	none		X
Elementary			
James John	none		X

Grades Served and Number of Students

A total of 1,824 students from grades 6-12 were instructed in computer literacy. Table 33 displays the schools, the grades, and the number of students from each school involved in the instruction of computer literacy.

Table 33
Computer Literacy Programs by School and Grade Level

School	Grades 6	7	8	9	10	11	12	Total Students
High School								
Benson					X			287
Grant					X	X	X	154
Jefferson				X	X	X	X	218
Lincoln				X	X	X	X	100
Middle								
Markham	X	X	X					244
Ockley Green	X	X	X					429
Tubman	X	X	X					315
Elementary								
James John		X	X					77
Total	X	X	X	X	X	X	X	1,824

Staff Training

All teachers in the Portland Public School District who taught computer literacy were university-trained in computer science. The amount of training ranged from two courses in computer programming to a master's degree in computer science.

Materials

One elementary school used the Random House's, "Spotlight on Computer Literacy." All the other schools in this survey used their own resources and experiences to develop their computer literacy program offerings.

EFFECTS OF COMPUTER LITERACY PROGRAMS

In the early 1970's when Arthur Leuhrmann first introduced the term "computer literacy," it meant a level of understanding which would enable students to talk about computers with little or no experience on computer terminals. Computer literacy has broadened in the past 10 years to include experience and instruction in a wide range of computer topics. At the present time there is no consensus on the precise knowledge, skills, or attitudes an individual needs to function adequately in a technological society. The National Science Foundation and the U.S. Office of Education have funded organizations, such as the Minnesota Educational Computing Consortium, the International Council for Computers in Education and Far West Regional Lab for the purpose of researching topics for computer literacy.

It is the intent of this section of the evaluation to survey the schools with computer literacy programs on the nine topics presently being stressed by the above organizations for computer literacy requirements. These topics are: (1) History of Computers; (2) Hardware Terminology; (3) Knowledge of How a Computer Works; (4) Software Experience; (5) Programming Skills; (6) Languages; (7) Limitations of the Computer; (8) Uses/ Misuses of Computers; and (9) Computer Careers.

Members of the Evaluation staff visited the eight schools covered in this report and interviewed participating teachers. Teachers tabulated the computer literacy topics which were included in their curricula.

Survey Results

Results of the computer literacy survey are displayed in Table 34. Each (X) represents an item which has been included in the computer literacy curriculum. Item descriptions and the extent of their inclusion in the computer literacy curricula are presented below.

(1) HISTORY OF COMPUTERS

The History of Computers traces the development of computers from pre-computer days to the present microcomputer age. Offered at 75% of the schools.

(2) HARDWARE TERMINOLOGY

Hardware Terminology defines input-output devices, circuit elements, control elements, memory storage, processors, and auxiliary equipment. Offered at 88% of the schools.

(3) KNOWLEDGE OF HOW A COMPUTER WORKS

Knowledge of How a Computer Works includes discussions of the hexadecimal system, logic and data structures. Offered at 100% of the schools.

(4) SOFTWARE EXPERIENCE

Software Experience gives students training in two types of software: (a) "canned" and (b) student programmed. The "canned" programs are used to perform word processing (editing and formatting text), to design worksheets (chart formatting and editing) or to create file systems (data bases for searching and sorting). The student-programmed software can be in the form of CAI (drill and practice exercises) or games/simulations (using graphics to create an environment). The survey showed that 75% of the schools offered Software Experience. Computer literacy students were exposed to word processing in 25% of the schools. In 50% of the remaining schools courses in word processing were offered in other parts of the curriculum. Experience with designing worksheets and writing CAI programs was not addressed by any of the computer literacy curricula. Creating games/simulations was available in 63% of the schools. Exposure to using file systems to search and sort data was found in 38% of the schools.

(5) PROGRAMMING SKILLS; AND (6) LANGUAGES

All of the computer literacy schools taught computer programming in the BASIC language. Table 34 shows the programming commands and skills taught in these schools. In regard to other languages, only one school introduced an alternative, LOGO, in its computer literacy course. In 25% of the schools high-level languages, such as FORTRAN, COBOL and Pascal, were taught in advanced computer courses for which computer literacy was a prerequisite.

(7) LIMITATIONS OF COMPUTERS

Students using the computer as a tool for inquiry and problem-solving discover the limitations of their system and relate their experiences to discussions of other computer systems in this course. Offered at 88% of the schools.

(8) USES/MISUSES OF COMPUTERS

The Uses/Misuses of Computers integrates the uses of the computer with issues relating to privacy and security. Offered at 75% of the schools.

(9) COMPUTER CAREERS

Computer Careers identifies the careers created by the computer industry, provides job market projections, and discusses educational requirements. Offered at 75% of the schools.

Table 34
Computer Literacy Topics Surveyed

	Software Experience									BASIC Programming Skills															Languages								
Content / Schools	History of Computers	Hardware Terminology	Knowledge of How a Computer Works	Word Processing	CAI	Worksheets	Games/Simulation	File Systems	Programming Skills	PRINT	LET	INPUT	READ-DATA	REM	GO TO	IF-THEN	Subroutines	Computing Functions	FOR-NEXT Loop	Random Generator	Strings	Arrays	Files	Graphics	BASIC	LOGO	FORTRAN	ADA	COBOL	PASCAL	Limitations of Computers	Uses/Misuses of Computers	Computer Careers
Benson	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0	X		*		*		X	X	X
Grant	X	X	X	#			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X
Jefferson	X	X	X	#	#				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	+	X		*		*	*	X	X	X
Lincoln		X	X		#			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
Ockley Gr.			X	X			X		X	X	X	X		X	X	X			X	X	X			X	X						X		
Markham	X	X	X						X	X	X	X	+	X	X	X	+	X	X	+			+	X	X						X	X	X
Tubman	X	X	X	*			X	*	X	X	X	X	X	X	X	X	+	+	X	X	X	+	+	X	X						X	X	X
James John	X	X	X	X			X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X						X	X	X

* Taught to students with more than one year of computer science.

# Taught to students specially enrolled in these courses.

+ Taught to students with more than nine (9) weeks of computer literacy.

0 Machines do not have the capability.

CONCLUSIONS AND RECOMMENDATIONS FOR COMPUTER LITERACY PROGRAMS

It is the purpose of this survey to determine the extent to which the "suggested" computer literacy topics are included in the computer literacy programs taught in the Portland Public Schools. Evidence of this survey suggests that all topics were addressed in 75% of the computer literacy schools.

All of the schools taught computer programming in BASIC. While this is an appropriate beginning language, the Educational Testing Service's Advanced Placement Exam in Computer Science only evaluates a student's performance in programming Pascal. Of the four high schools in this survey, only one offers programming in Pascal. We recommend consistency in program language offerings and examination of other languages such as LOGO and input from employment-related groups such as the Vocational Education Department.

Every school in this survey developed its own computer literacy materials. Consistency in computer literacy program offerings district-wide can be furthered by pooling these innovative materials to create a computer literacy resource bank organized according to the guidelines proposed by the Curriculum Department Computer Science Scope and Sequence K-12.

We recommend that the continuing development and extension of computer literacy programs district-wide follow the Computer Science Scope and Sequence in order to provide a comprehensive instructional program to develop computer literacy skills at all levels.

CHAPTER 4

COMPUTER MANAGEMENT

INTRODUCTION

Although the central administration Data Processing Department has routinely used computers in its operations for some time, placement of computer management systems in individual schools is just beginning. Building access to a central informational network provides a useful communication link which supports effective and efficient recording and organizing of local student population data. The development of such systems suggests a potential for improving educational management practices in the schools, and providing new resources for instructional planning as well.

CHARACTERISTICS OF COMPUTER MANAGEMENT

The Data Processing Department and two volunteer high schools cooperated in the development and fine tuning of an on-line student information system. The programs were functional at Lincoln and Grant High Schools from early September 1982 through the school year into June 1983.

The On-Line Student Information system is designed as an alternative to the batch updates and maintenance of student records. This system is written for a transaction processing environment to run on an IDS-II Database and allows immediate update and inquiry of student information via formatted screens. It consists of three major functions:

(1) Student number verification by student last name;
(2) Update and inquiry of student information for those students currently enrolled in the user school;
(3) Registration of new students and transfer of current students from one school to another.

The verification of student numbers through a program called "SOUNDX" was developed to assist schools using the on-line system with researching student numbers. For example, if a student is transferring from another school within the District, his/her student number can be obtained by using this function. The use of this program helps to prevent the assignment of a new student number to a student who already has one, as well as assisting the identificaton of students with more than one student number.

The update and inquiry phase of this system allows the specific user school to access records for those students enrolled in that school. This controlled access is accomplished through security routines when the system is accessed and the function is requested. The information available for updating in this function matches the layout of the Student Registration or Data Transmittal Form. After a specific screen is filled, the data which has been entered is verified and/or edited. Appropriate error messages are sent and the user must correct the data before any permanent changes are made to a student's record. In addition, the user may request a summary of all of the SDT information including a detailed course listing for a selected quarter and year. A summary of grades by quarter and year is also available.

The registration and transfer function is used when the user school wishes to register a student in their school. If the student is enrolled in another school, a provisional leave code is entered for the old school which allows the old school thirty days to update any relevant information and issue a valid leave code and date. If a student has never been enrolled in a Portland school, this function will verify that the number used is not already assigned to a student in the District, collect specific required information, and then provide access to all of the screens available through the update and inquiry function.

Planned enhancements of this system include making test scores available on an inquiry basis for students, the ability to add or update the Master Course Directory, and provision for a class list by section.

EFFECTS OF COMPUTER MANAGEMENT

In order to investigate the nature and extent of computer management, on-site visitations were made to Lincoln and Grant High Schools by a central administration team consisting of the District's senior systems analyst from Data Processing and representatives of the Evaluation Department. Informal interviews with school administrators and data processing clerks were conducted. The schools' computer management system was demonstrated in operation.

CONCLUSIONS AND RECOMMENDATIONS FOR COMPUTER MANAGEMENT

The system was sufficiently well designed to be valuable to the schools during the time it was being refined through feedback information and requests from the schools to the Data Processing Department. This constituted a realistic trial of the system and improvements were made during this developmental period. The system was judged by the schools and the Data Processing Department to be fully operational and will be placed in eight other high schools requesting the services.

Investigations at the Computer Management installations in the two high schools showed that an efficient and useful communication link was established with the Data Processing Department's data base and that internal information exchange within the school was facilitated. Expansion of the network to other schools is considered reasonable.

CHAPTER 5

SUMMARY

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EVALUATION REPORT ON COMPUTER-ASSISTED INSTRUCTION AND PRESCRIPTION LEARNING PROGRAMS

At the request of the Curriculum Department and the Title I coordinators for Portland Public Schools, two computer-based instructional programs, Computer-Assisted Instruction and Prescription Learning, were evaluated during the 1981-82 school year. Since summative evaluation of these important and extensive educational programs during their first year of implementation was not reasonable as is usual, continued evaluation of CAI and Prescription Learning was required by Central Administration for the 1982-83 school year.

Computer-Assisted Instruction (CAI) was used to supplement instruction in mathematics, reading, and language usage. Prescription Learning is a multi-media management program in which the computer is used in program management and is also one of the instructional media. It was also used as a supplemental instructional program for mathematics, reading and language usage. CAI and Prescription Learning are both essentially drill and practice programs. Both programs are described in detail in preceding report sections.

For both programs, effectiveness in aiding student achievement in one or more of the basic skills was measured on a student-by-student basis. Progress for each student in both programs of 1982-83 was matched and compared with their progress during the previous year before they had CAI. Their progress was also compared to that of the rest of the Chapter I student population (not including students enrolled in Prescription Learning) during the same school year, 1982-83.

The numbers of students in grades 5 through 8 were large enough to judge the degree of effectiveness of each program as it was implemented for the second time. This second year-long, full-scale implementation of the programs provided ample opportunity for inservice of staff members and testing of the hardware and software in preparation for the 1982-83 school year. Also, recommendations of a formative evaluation nature were available from the 1981-82 school year evaluation report.

Information on the overall effectiveness of CAI and Prescription Learning in aiding gains in basic skills achievement over the previous year's gains is presented in Table 35. The probability that a program's degree of effectiveness will fall in the "No Gain or Loss" category is 50%; probability is between 49% and 10% that non-significant negative or non-significant positive values would occur by chance, and between 10% and 5% for a positive or negative gain approaching significance. Positive (or negative) gains with probabilities of 5% or less are commonly accepted as strong indications that a program is facilitating (or inhibiting) what is measured.

Table 35

Overall Effectiveness of Computer-Based Instruction Programs in Supporting Gains in Basic Skills Achievement

	N	Non-Significant Negative Gain (-1.6 to -.7)	No Gain or Loss (-.7 to .7)	Non-Significant Positive Gain (.7 to 1.6)	Positive Gain Approaching Significance (1.7 to 2.0)	Positive Significant Gain (2.0 and above)
		Less Gain with Computer-Based Instruction	No Gain with Computer-Based Instruction		Greater Gain with Computer-Based Instruction	
CAI						
Math	151		X			
Reading	47	X				
Language Usage	74	X				
Prescription Learning						
Math	140		X			
Reading	262		X			
Language Usage	265		X			

Neither CAI nor Prescription Learning demonstrated positive, significant gains. Indeed, the "gains" for CAI were negative in reading and language usage and were at the "no gain or loss" level in mathematics. Prescription Learning exhibited no gain or loss in mathematics, reading or language usage.

Comparison with Other Chapter I Programs

Table 36 presents the measures of effectiveness of (1) Computer-Assisted Instruction grades 5-8; (2) Prescription Learning grades 3-8; and (3) all Chapter I programs grades 5-8, but not including those students in the Prescription Learning Program. The most informative values are in the far right column. They show the progress of students by comparing 1982-83 fall to spring gains achieved while students were being taught within the new program, with the 1981-82 gains made the previous school year, before entering the new program. These values are based on the average performances of groups of students throughout the District. A graphic value of 0 is right on the District average. If the values are negative, it indicates performance less than expected for a group of students in the District under regular school conditions. For single groups, a value greater than .70 is considered a non-significant, positive difference from the average and a value less than -.70 is a non-significant, negative difference. A plus or minus 2.00 is considered significant at the .05 level. Figures in parentheses indicate numbers of students included in performance comparisons.

Table 36

Standard Deviation Means Showing Growth and RATE of Growth for Students Enrolled One Year, 1982-1983, in Supplementary Instructional Programs

Program	Subject	Deviations of Growth From Fall to Spring		Deviations of Year to Year RATE of Growth 1981-82 to 1982-83
		F 81-Spr 82 Without Computer-Based Instruction	F 82-Spr 83 With Computer-Based Instruction	
Computer-Assisted Instruction	Mathematics	.54 (160)	.31 (196)	-.40 (151)
	Reading	.79 (40)	-.27 (54)	-1.45 (47)
	Language Usage	2.30 (69)	1.80 (83)	-1.09 (74)
Prescription Learning	Mathematics	.22 (147)	1.11 (241)	.23 (140)
	Reading	-.68 (225)	.66 (361)	.51 (262)
	Language Usage	.23 (225)	1.62 (364)	.54 (265)
Chapter I	Mathematics	.49 (654)	.80 (795)	.03 (575)
	Reading	.68 (648)	.41 (767)	-.20 (693)
	Language Usage	1.81 (280)	1.08 (306)	-.70 (304)

The importance of Table 36 is in the way information is reduced to make apparent the achievement effects of the programs for elementary students who have participated in them for one year. Very little importance is given a single, small difference, but when all three year-to-year differences are negative, as for CAI, the tendency toward an unfavorable evaluation is increased. Prescription Learning differences in mathematics, reading and language usage show no significant gain or loss for grades 3 through 8, but the fact that all three are above 0 is noteworthy.

CONCLUSIONS ABOUT COMPUTER-ASSISTED INSTRUCTION AND PRESCRIPTION LEARNING PROGRAMS

Computer-Assisted Instruction

1. The data using students' achievement records from six Portland elementary schools at grades 5 through 8 where four Computer-Assisted Instruction software curricula were implemented show that student learning in the basic skills has not been improved. These CAI programs were: (1) Computer Curriculum Corporation Mathematics, Reading, Language Usage, (2) Milliken Math, Reading, Language Usage, (3) Random House Mathematics and Language Usage, and (4) Radio Shack K-8 Math.

2. Mean achievement gains for students participating in each of the CAI programs were less than normally expected of groups throughout the District and less than those of other Chapter I groups (excluding the students who were in the Prescription Learning program). Small differences were found between schools and between subjects, but none of the differences are statistically significant at the 5% level.

3. The data included only students who had more than one semester and more than 300 minutes working time on computers in these software curricula. However, there was no relationship between the number of minutes and achievement gain over the year in any subject.

4. A survey of the attitudes of students in the CAI programs showed that students liked working on the computer and thought it helped them learn.

5. These findings lead to the conclusion that the CAI programs in current use are not effective in improving basic skills achievement.

Prescription Learning

1. The data from achievement records in twelve Portland elementary schools where Prescription Learning was used as a Chapter I supplementary program show that there are some significant differences between gains of the greatest and least achieving groups by schools and by grade levels. When the Prescription Learning basic skills achievement data are considered, overall, Prescription Learning gains are at least equivalent to those of all student groups at the same grade levels district wide as shown under "RATE of Growth" in Table 36.

2. Data comparing the achievement gains of students in Prescription Learning in grades 3 through 8 with gains of students in all other Chapter I

supplementary programs show Prescription Learning students making more progress in basic skills achievement though their gains are not enough to be considered significant.

3. Data comparing the gains of Chapter I second grade students in Prescription Learning with gains of other District Chapter I second grade students show that the differences between the two groups are so small that their performance is actually equivalent.

4. When comparing the performance of students who participated in Prescription Learning for one year 1982-83 with students who participated in the program for one year 1981-82, achievement results are neither better nor worse for either one-year group.

5. The performance of Prescription Learning students who participated in the program for two full years (1981-82 and 1982-83) is neither better nor worse than the performance of students who participated in Prescription Learning for only one year (1982-83).

6. There is no relationship between the number of weeks students participated in Prescription Learning and the amount of achievement gain made for the 1982-83 school year.

7. When the curriculum goals of Prescription Learning are compared with the Portland Achievement Levels Tests goals, there is a reasonable match for reading goals, a real disparity of coverage and focus for mathematics goals, and an extremely poor correspondence in language usage goals.

8. The findings support the conclusion that Prescription Learning as it is implemented in Portland to supplement basic skills instruction is at least as effective as an average of the other supplementary programs used in other Chapter I schools, but like them, is not on average assisting students in making significant achievement gains.

RECOMMENDATIONS FOR COMPUTER-ASSISTED INSTRUCTION AND PRESCRIPTION LEARNING PROGRAMS

Our existing efforts to use Computer-Assisted Instruction in the elementary schools are overall a failure. The evidence is that CAI, as implemented for the last two years, is not an effective supplement to instruction in the basic skills. This evidence suggests termination of this program. Further effort to modify existing CAI programs does not seem to be warranted.

Prescription Learning is slightly more effective than the average of other Chapter I supplementary instructional programs. The match between the Prescription Learning curriculum goals and the Portland Public School curriculum goals, however, needs improvement, and a more effective program should be sought.

Accordingly, the following recommendations are made:

1. The CAI programs now being implemented (CCC and Milliken Mathematics, Reading and Language Usage, Random House Mathematics and Language Usage, and Radio Shack K-8 Math) should be phased out as soon as possible.

2. Prescription Learning should be maintained but not expanded to other schools until improvements are made to more closely match the Prescription Learning instructional program with District curriculum goals, especially in the subject areas of mathematics and language usage, and the effect of these improvements on student learning are evaluated.

3. Reiterating the recommendation of the previous year's study, "It is evident that other software, other curriculum or instructional activities, and other scheduling patterns than those used in 1981-82 (and 1982-83) should be tried under carefully-controlled conditions."

4. It is also recommended that a concerted effort be made to understand the educational effect of any CAI implementation for students and teachers. This is necessary to a) ensure against negative side effects in shaping students' learning processes; and b) to determine how best to assist teachers in changing instructional practices to make use of the best features of computer-assisted teaching.

5. It is recommended that the Curriculum Department compare District curriculum goals with those of any CAI software programs considered for use, and that an inventory of goals not included within software programs be provided to assist teachers in planning appropriate instruction.

6. It is of primary importance to students that the uses of computers for educational purposes be systematically studied and understood before they are imposed on the school population.

7. We strongly recommend that the Curriculum Department and the Department of Instructional Technology identify high-priority questions, in order to provide theoretical and logistical bases for evaluation. A list of questions representing a large number of important considerations is presented in the Computer-Assisted Instruction section of this report.

If, as recommended, other and more promising computer-related software, curricula, instructional activities and scheduling patterns are adopted for in-District, in-depth tryout, the Research and Evaluation Department will work with program personnel to develop a reasearch and evaluation design that will both test the effectiveness of those innovations and begin to respond to more fundamental questions such as those referred to above.

EVALUATION REPORT ON COMPUTER LITERACY PROGRAMS

Individual schools in the Portland Public School District have initiated computer literacy programs in hopes of educating their students and staff in the programming and use of computers. This report gives the results of a survey addressing the curriculum design and the extent of student participation in computer literacy programs.

It was the purpose of this survey to determine the extent to which the "suggested" computer literacy topics are included in the computer literacy courses taught in the Portland Public Schools. Evidence of this survey suggests that all topics were addressed in 75% of the computer literacy schools.

All of the schools taught computer programming in BASIC. While this is an appropriate beginning language, the Educational Testing Service's Advanced Placement Exam in Computer Science only evaluates a student's performance in programming Pascal. Of the four high schools in this survey, only one offers programming in Pascal.

CONCLUSIONS AND RECOMMENDATIONS FOR COMPUTER LITERACY PROGRAMS

An inventory of the offerings in computer literacy programs in eight schools shows a wide but defensible variety in content. However, course goals for computer literacy are not as clearly specified as in other curricular areas. The intent in this report was to survey rather than evaluate Computer Literacy since instruction is diverse and computer literacy tests are not yet available for use in our District.

1. We recommend consistency in program language offerings and examination of other languages such as LOGO.

2. Every school in this survey developed its own computer literacy materials. Consistent District computer literacy instruction might be furthered by pooling these innovative materials to create a computer literacy curriculum resource bank from which to draw in the continuing development of computer literacy programs. We recommend that content for computer literacy programs be developed according to guidelines which have been outlined by the Curriculum Department in the Computer Science Scope and Sequence.

EVALUATION REPORT ON COMPUTER MANAGEMENT

During the fall of 1982 a pilot data base management program for storing student information and recording attendance was implemented in two high schools. The evaluation report described the effects of the pilot management programs.

CONCLUSIONS AND RECOMMENDATIONS FOR COMPUTER MANAGEMENT

The system was sufficiently well designed to be valuable to the schools during the time it was being refined through feedback information and requests from the schools to the Data Processing Department. This constituted a realistic trial of the system and improvements were made during this developmental period. The system was judged by the schools and the Data Processing Department to be fully operational and will be placed in eight other high schools requesting the services.

Investigation at the Computer Management installations in the two high schools showed that an efficient and useful communication link was established with the Data Processing Department's data base and that internal information exchange within the school was facilitated. Expansion of the network to other schools is considered reasonable.

APPENDIX A:

- Description of Computer Use in Portland Public Schools

ABERNETHY

EQUIPMENT

The equipment in the computer lab consists of five TRS-80 microcomputers with black and white monitors.

COMPUTER USE

1. CAI

   Supplemental instruction for Chapter I students in mathematics is provided for 10 minutes per day using the Radio Shack K-8 Math software.

APPLEGATE

EQUIPMENT

The Prescription Learning lab is equipped with one 16K and four 32K Commodore Pets with one single disk drive, one dual disk drive and one printer. In addition, the lab contains two Dukane readers, one Hoffman reader, one card reader and two tape players.

COMPUTER USE

1. Prescription Learning

   The Applegate Chapter I program adopted the Prescription Learning program to provide supplemental instruction to low-achieving students. The program served 55 students in reading and 25 students in math in grades one through five. Students received supplemental instruction for 30 minutes per day, five days per week. Since Prescription Learning is a multi-media program, students spent only a portion of their daily instruction time on the computer.

BEACH

EQUIPMENT

The Prescription Learning lab is equipped with three 16K and one 32K Commodore Pets with one single disk drive, one dual disk drive and one printer. In addition, the lab contains two Dukane readers, one Hoffman reader, one card reader and two tape players.

COMPUTER USE

1. Prescription Learning

   Beach School adopted Prescription Learning as part of its Chapter I program to provide supplemental instruction to low-achieving students. The program served 69 students in reading and 65 students in math in grades kindergarten through five. Students received supplemental instruction for 30-45 minutes per day, two to five days per week depending upon grade level. Since Prescription Learning is a multi-media program, students spent only a portion of their daily instruction on the computer.

BENSON HIGH SCHOOL

EQUIPMENT

The equipment in the computer lab consists of three terminals linked to the District's mainframe, two with monitors and one with a line printer. There are two microcomputers, an Altair with a monitor and a printer, and a nonfunctioning Commodore Pet. The library houses an Apple II-Plus with two disk drives and a color monitor.

COMPUTER USE

1. Computer Science Department

   Computer Literacy is offered to all 10th grade students. Advanced programming courses are offered at all grade levels. Instruction in the advanced classes consists of advanced BASIC, FORTRAN, COBOL, and business applications.

BENSON HIGH SCHOOL (Continued)

2. Educational Management

   An attendance program written in COBOL by two sophomore students logs in student absentees period by period. The program has the capability to search for pattern absentees and to generate letters to parents informing them of their child's absences.

BOISE

EQUIPMENT

In the computer lab there are eight CCC terminals and one printer linked to the minicomputer at Jefferson High School.

COMPUTER USE

1. CAI

   In the morning, students in grades 2-8 receive supplemental instruction in mathematics for 10 minutes per day on the CCC terminals. In the afternoon, low-achieving 5th-8th grade students receive supplemental instruction in reading and language usage for 20 minutes per day.

BUCKMAN

EQUIPMENT

The Prescription Learning lab is equipped with three 16K and one 32K Commodore Pets with one single disk drive, one dual disk drive and one printer. In addition, the lab contains two Dukane readers, two Hoffman readers, one card reader and two tape players.

COMPUTER USE

1. Prescription Learning

   Buckman School adopted Prescription Learning as part of its Chapter I program to provide supplemental instruction to low-achieving students. The program served 108 students in reading and 71 students in math in

BUCKMAN (Continued)

grades 2 through 8. Students received supplemental instruction for 35 minutes per day, four days per week. Since Prescription Learning is a multi-media program, students spent only a portion of their daily instruction on their computer.

CLARENDON

EQUIPMENT

The Prescription Learning lab is equipped with two 16K and one 32K Commodore Pets with one single disk drive, one dual disk drive and one printer. In addition, the lab contains two Dukane readers, two Hoffman readers, one card reader and two tape players.

COMPUTER USE

1. Prescription Learning

   Clarendon School adopted Prescription Learning as part of their Chapter I program to provide supplemental instruction to low-achieving students. The program served 55 students in reading and 44 students in math. Students received supplemental instruction 30 minutes per day, two or three days per week depending upon the student's schedule. Since Prescription Learning is a multi-media program, students spent only a portion of their time on the computer.

GEORGE

EQUIPMENT

The Prescription Learning lab is equipped with three 8K, two 16K and one 32K Commodore Pets with one single disk drive, one dual disk drive and one printer. In addition, the lab contains two Dukane readers, two card readers and three tape players.

GEORGE (Continued)

COMPUTER USE

1. Prescription Learning

   George School adopted Prescription Learning as part of their Chapter I program to provide supplemental instruction to low-achieving students. The program served 66 students in reading and 64 students in math in grades four through seven. Students received supplemental instruction for forty minutes per day, five days per week. Since Prescription Learning is a multi-media program, students spent only a portion of their daily instruction on the computer.

GRANT HIGH SCHOOL

EQUIPMENT

The Computer Literacy lab is equipped wth 25 Commodore Pets with cassettes. There is also one single disk drive and one set of dual disk drives. Each computer is equipped with a non-color monitor. There is a 25 inch monitor of class presentations. One printer terminal is available for hooking up to the District's mainframe. Three Apple II-Pluses are housed in the library. Another Apple II-Plus is in the Business Department.

COMPUTER USE

1. Computer Science Department
   - a. Computer Literacy

     Presently four full year and two semester classes in computer literacy are being taught. The courses consist mostly of juniors and seniors. There are a few sophomores and no freshman. The language is BASIC.
   - b. Advanced Programming

     10 students are involved in advanced programming after class. The instruction emphasizes team programming and uses BASIC and Assembly languages.

GRANT HIGH SCHOOL (Continued)

2. Business Department
   a. Word Processing

      The word processing instruction is limited by the use of an old CRT and limited memory typewriters. The course is taught to advanced typing students.

   b. Accounting

      Students in the advanced accounting class are using the microcomputer to learn about computerized accounting procedures.

3. Library Service

   Three Apple computers are used for storing library information.

4. Management

   A pilot program with the District is being used to record attendance on a data base containing name, sex, birth, ethnic.

5. Teacher Education

   Computer literacy is taught to School District personnel after school hours.

6. Night School

   Two classes of computer literacy are taught to the community.

JAMES JOHN

EQUIPMENT

In the computer lab there are 14 TRS-80 microcomputers with black and white monitors and one printer.

COMPUTER USE

1. CAI

   Random House and Radio Shack software are used to supplement instruction in mathematics to seventh and eighth grade students.

JAMES JOHN (Continued)

Random House software is also used to supplement instruction in language usage to fourth, fifth and seventh graders.

2. Computer Literacy
   Computer literacy is offered as an elective to eighth graders.

3. Computer Management
   A microcomputer is used to generate goal reports for each class, record absentees, and maintain class lists.

JEFFERSON HIGH SCHOOL

EQUIPMENT

The computer lab at Jefferson High School houses 30 terminals linked to the School District's mainframe of which 27 use CRT's and three use a printer. The Chapter I lab contains 16 terminals linked to the minicomputer which is located at Jefferson. In the library there is an Apple II-Plus with two disk drives and a color monitor. The Social Studies Department has four Apple II-Plus microcomputers, and the Business Department has six word processors.

COMPUTER USE

1. Computer Science Department
   Jefferson High School offers a four-year computer science curriculum. The first-year course may be taken by all grade levels of students provided they have successfully completed Math 1-2. This first course is commonly termed "computer literacy." All students graduating from Jefferson have completed this course. The second year course contains more in-depth programming in BASIC with the addition of either FORTRAN, COBOL, or Pascal. The last two years of instruction emphasize problem-solving skills through computer programming. In cooperation with government agencies, banking institutions and transportation systems, students are provided with on-the-job training in computer related fields for one-half of their senior year.

JEFFERSON HIGH SCHOOL (Continued)

2. Business Department

   Word processing is taught two periods per day to instruct students in legal document typing, legal office procedures, and word processing in preparation for employment.

3. Social Science Department

   The Social Science Department is using computers to create simulations for real life enactments.

4. CAI

   CCC software provides supplemental instruction in reading, mathematics, and language usage to Chapter I students or students who have not yet passed graduation standards.

5. Physical Education Department

   The Physical Education Department uses the microcomputer to record students' performance on competencies tests. The Department also records injuries in terms of types and frequencies.

6. Teacher Education

   A Ford Foundation Grant is being used for total staff inservice on new technology with hands-on experience. Classes are scheduled three nights per week.

7. Library Service

   Teachers may use the computer to preview CAI programs and generate teaching materials, and to receive instruction in the capabilities of the microcomputer. The librarian uses the computer to create bibliographies and overdue notices.

KELLOGG

EQUIPMENT

The Prescription Learning lab is equipped with three 8K and one 32K Commodore Pets with one dual disk drive and one printer. In addition, the lab contains three Dukane readers, one Hoffman reader, two card readers and two tape players.

COMPUTER USE

1. Prescription Learning

   The Kellogg Chapter I program adopted the Prescription Learning program to provide supplemental instruction to low-achieving students. The program served 114 students in reading and 91 students in math in grades 6 through 8. Students received instruction for 45 minutes per day, five days per week. Since Prescription Learning is a multi-media program, students spend only a portion of their instructional time on the computer.

KELLY

EQUIPMENT

The Prescription Learning lab is equipped with two 16K and one 32K Commodore Pets with one single disk drive, one dual disk drive and one printer. In addition, the lab contained two Dukane readers, two Hoffman readers, one card reader and two tape players.

COMPUTER USE

1. Prescription Learning

   Kelly School adopted Prescription Learning as part of their Chapter I program to provide supplemental instruction to low-achieving students. The program served 79 students in reading and 32 students in math in grades two through eight. Students received supplemental instruction for 30 minutes per day, five days per week. Since Prescription Learning is a multi-media program, students spent only a portion of their daily instruction on the computer.

LINCOLN HIGH SCHOOL

EQUIPMENT

The equipment in the computer lab consists of 24 Commodore Pets, two TRS-80's (one with color) and two DecWriters linked to the District's mainframe.

COMPUTER USE

1. Computer Literacy

   Computer Literacy is taught to students who are enrolled in or have completed geometry. These classes are 45 minutes each day and the course is one year in length.

2. CAI

   CAI is provided twice a week for remediation in mathematics, reading, and language usage for students who have not yet met the graduation standards. CAI is also provided once a week for each foreign language class. CAI was also developed for the geometry students.

3. Management

   A pilot program with the District is being implemented to record attendance and student information.

MARKHAM

EQUIPMENT

The computer center contains six Apple II-Plus microcomputers and one printer. There are five color monitors and one green screen.

COMPUTER USE

1. CAI

   The CAI program supplements basic skills instruction in mathematics, reading and language usage to low-achieving students using the Milliken and the Minnesota Educational Computing Consortium software.

2. Computer Management

   Wordstar and Super-Calc are used to record and report student progress on the CAI programs to the classroom teachers.

MEEK

EQUIPMENT

The Prescription Learning lab is equipped with two 16K and one 32K Commodore Pets with one single disk drive, one dual disk drive and one printer. In addition, the lab contains two Dukane readers, one Hoffman reader, one card reader and two tape players.

COMPUTER USE

1. Prescription Learning

   The Meek Chapter I program adopted the Prescription Learning program to provide supplemental instruction to low-achieving students. The program served 77 students in reading in grades 2 through 5 and five students in math in grade 3. (The math program began in April, 1983.) Students received supplemental instruction for 30 minutes per day, five days per week. Since Prescription Learning is a multi-media program, students spent only a portion of their daily instructional time on the computer.

OCKLEY GREEN

EQUIPMENT

The Prescription Learning lab is equipped with three 8K and one 32K Commodore Pets with one dual disk drive and one printer. In addition, the lab contains three Dukane readers, one card reader and four tape players.

COMPUTER USE

1. Prescription Learning

   The Ockley Green Chapter I program adopted the Prescription Learning program to provide supplemental instruction to low-achieving students. The program served 105 students in reading and 92 students in math in grades six through eight. Students received supplemental instruction for 40 minutes per day, five days per week. Since Prescription Learning is a multi-media program, students spent only a portion of their daily instruction on the computer.

PENINSULA

EQUIPMENT

The Prescription Learning lab is equipped with three 16K and one 32K Commodore Pets wih one single disk drive, one dual disk drive and one printer. In addition, the lab contains two Dukane readers, one Hoffman reader, one card reader and two tape players.

PORTSMOUTH

EQUIPMENT

The computer lab contains one printer and eight CCC terminals linked to the minicomputer at Jefferson High School.

COMPUTER USE

1. CAI

   CAI is used to supplement instruction to Chapter I students in mathematics, reading and language usage. Since the CAI program is aimed at individual needs, daily time on the computer varies for each student.

2. Community Education

   The GED night class uses the computers for drill and practice exercises.

SELLWOOD

EQUIPMENT

The Prescription Learning lab is equipped with three 8K and one 32K Commodore Pets with one dual disk drive and one printer. In addition, the lab contains three Dukane readers, two card readers and four tape players.

COMPUTER USE

1. Prescription Learning

   The Sellwood Chapter I program adopted the Prescription Learning program to provide supplemental instruction to low-achieving students. The program served 108 students in reading and 91 students in math in grades 6 through 8. Students received supplemental instruction for 37 minutes, five days per week with a portion of the time spent on the computer.

TUBMAN

EQUIPMENT

There are two computer labs at Tubman. One contains 35 TRS-80 microcomputers with black and white monitors and a printer, and the other contains eight CCC terminals and a printer linked to the minicomputer at Jefferson High School.

COMPUTER USE

1. CAI

   Chapter I or low-achieving students are supplemented in mathematics, reading and language usage basic skills by receiving CAI instruction for 10 minutes per day using the CCC software. Other Chapter I or low-achieving students receive supplemental mathematics instruction in basic skills using the Radio Shack software from 10 to 20 minutes per day.

2. Computer Literacy

   Three levels of computer literacy are offered as an elective: beginning, intermediate and advanced.

WHITAKER

EQUIPMENT

The Prescription Learning lab is equipped with three 8K and one 32K Commodore Pets with one dual disk drive and one printer. In addition, the lab contains three Dukane readers, two card readers and three tape players.

COMPUTER USE

1. Prescription Learning

   Whitaker adopted Prescription Learning as part of their Chapter I program to provide supplemental instruction to low-achieving students. The program served 107 students in reading and 124 students in math in grades 7 and 8. Students received supplemental instruction for 40 minutes per day, five days per week and a portion of that time was spent on the computers.

APPENDIX B:

Description of Computer-Based Instructional Program Software

- CCC Curriculum
- Milliken Math Curriculum
- Prescription Learning Curriculum
- Radio Shack Curriculum

DESCRIPTION OF CCC CURRICULUM

Three of the schools in the CAI study used one or more of the following courses from Computer Curriculum Corporation:

- Mathematics Strands, Grades 1-6
- Reading, Grades 3-6
- Language Usage, Grades 3-6

In these courses the strands instructional strategy is used to provide drill and practice in basic mathematics, reading or language skills. A content area in a curriculum is represented by a strand. Each strand is a string of related exercises which are arranged by their relative difficulty. A computer program records a student's position and performance for each strand. The computer will compare a student's performance in each strand with a preset performance criteria to determine if a student: (a) needs more practice at the same level of difficulty within a strand; (b) needs to move back for more remedial work; or (c) has mastered the current concept and can move on to the next level of difficulty. A normal lesson consists of a mixture of exercises from different strands. Random selection ensures the student will work on a variety of items.

In Mathematics Strands, Grades 1-6, there are 14 strands or content areas. These are listed in Table B.1.

Table B.1
The Strands in CCC Mathematics, Grades 1-6

Strand	Name
1	Number Concepts
2	Horizontal Addition
3	Horizontal Subtraction
4	Vertical Addition
5	Vertical Subtraction
6	Equations
7	Measurement
8	Horizontal Measurement
9	Laws of Arithmetic
10	Vertical Multiplication
11	Division
12	Fractions
13	Decimals
14	Negative Numbers

Each strand is organized into a set of exercises with similar properties. During each session a student receives exercises from all strands with similar properties that are appropriate for the student's performance level. The number of exercises a student receives in each strand is not equal. The program adjusts the ratio of exercises in each strand to match the ratio of exercises covering that concept in an "average textbook."[1] The curriculum material is in the form of algorithms, not specific exercises stored in the memory.

> When a particular equivalence class is selected, a program generates the numerical values used in the exercise, produces the required format information for the presentation of the exercise and calculates the correct response for comparison with student input. As a result, the arrangement of the lesson and the actual exercises presented differ between students at the same level and between lessons for a student who remains at a constant grade placement for several lessons.[2]

The Reading, Grades 3-6 curriculum presents reading practice items designed to improve a student's skills in five areas: word analysis, vocabulary extension, comprehension of sentence structure, interpretation of written material, and development of study skills. The program contains four years of course work (grades 3, 4, 5, and 6) and also offers remedial work starting at grade 2.5. The program is divided into two parts: Basic Sentences and Strands. Basic Sentences, which covers grade level 2.5 to grade level 3.5, contains items which are easy and short in duration. The Strands start at grade level 3.5 and end at grade level 6.9. The five Reading Strands are listed in Table B.2.

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[1] Macken, Elizabeth. "Evaluation Studies of CCC Elementary - School Curriculums 1971-1975." pg. 5.

[2] Ibid.

Table B.2

The Strands in Reading, Grades 3-6

Strand	Name
1	Word Attack -- analyzing words as units
2	Vocabulary -- building a reading vocabulary
3	Literal Comprehension -- understanding the literal meaning of sentences and short paragraphs
4	Interpretive Comprehension -- reading sentences for interpretation
5	Work-Study Skills -- learning to use resources effectively

During a session the student receives exercises from all five strands.

Language Usage, Grades 3-6, covers four years of course work (grades 3, 4, 5, and 6). The program offers supplemental work for ESL students and reading-impaired students. It is not the intent of this program to stress grammar or grammatical terms--language usage is its major concern. The program is divided into two parts: Language Usage Strands and Language Usage Topics. The same content is contained in both programs. The instructional formats are different. Language Usage Strands uses the strand structure to provide individualized drill in eight areas. These strands are listed in Table B.3.

Table B.3

The Strands in CCC Language Arts, Grades 3-6

Strand	Name
1	Principal Parts of Verbs
2	Verb Usage
3	Subject-Verb Agreement
4	Pronoun Usage
5	Contractions, Possessives, and Negatives
6	Modifiers
7	Sentence Structure
8	Mechanics

The Language Usage Topics program instructs all students at the same time on a topic selected by the teacher with the level of instruction being individualized.

DESCRIPTION OF MILLIKEN MATH CURRICULUM

Milliken Math was used by only one school in the CAI study. The program consists of a set of twelve drill and practice programs in basic mathematics operations. The programs are called "sequences," and each sequence provides a series of problem levels from simple to complex. Problems are selected for each level by the range of numbers involved, the numbers of steps in the computation, vertical or horizontal format, and special properties of the operation. The curriculum content is suitable for grades 1-8, and is correlated with standard basic mathematics programs. Table B.4 displays the sequence content areas.

Table B.4

Curriculum Content of Milliken Math

Basic Mathematics Operations	Number of Problem Levels Within Sequence
Number Readiness	16
Addition	60
Subtraction	54
Multiplication	62
Division	64
Laws of Arithmetic	19
Integers	32
Fractions	36
Decimals	56
Percents	15
Equations	26
Measurement Formulas	25

Duplicating masters which accompany the program provide problem level examples which may be used for initial student placement in the program. Student progress is monitored by the computer and students are moved forward or back through a sequence until specific achievement criteria are met. A 70% to 90% accuracy level indicates mastery and allows a student to move to a more complex problem level within a sequence. 30% to 70% accuracy suggests failure and the student is moved back to simpler levels within a sequence. The classroom teacher may determine specific achievement criteria within these suggested mastery/failure ranges.

Ten to twenty minutes is the recommended time for student use of the computer. Students generally have two opportunities to solve problems correctly. If a problem requires extra steps (such as long division), extra chances are provided. Teachers can program individual or class assignments within the mathematics sequences, and they may select appropriate animated or textual reinforcement for correct student responses.

The Manager Program records individual student progress and provides printouts of performance records. It is possible to use Milliken Math sequences for drill and practice without the Manager Program, and in that case no student records are maintained.

DESCRIPTION OF PRESCRIPTION LEARNING CURRICULUM

Prescription Learning is a diagnostic, prescriptive management program from Prescription Learning Corporation. The program provides individualized instruction through the use of six instructional strategies:

(1) Computer-assisted instruction
(2) Card readers
(3) Film strips
(4) Audio machines
(5) Workbooks
(6) Teacher-directed activities

Students are pre-tested at the beginning of the school year with tests developed by Prescription Learning Corporation or by an SRA Achievement Test. The results of the pretest are used to: (1) place the student appropriately in a skills continuum; (2) diagnose the specific skills in the continuum the child needs to master; and (3) match deficiencies of the student with appropriate instructional strategies and available materials.

The matching process, which is computerized, generates a prescription for the student. This prescription is based on stored results of the success and failure of strategies and materials for teaching different skills. A short-form skill instrument that requires 66.7% correct for mastery is used to post-test the students. A student will continue work in a particular skill if mastery is not met. The continued work will be supplied by an updated prescription.

The Prescription Learning curriculum used in Portland has objective continuums in reading and math. The reading continuum has five levels: grades 1.5-2.5, 3.0-4.0, 5.0-6.5, 7.0-8.5, and 9.0-10.5. Level 1 and 2 are considered intermediate, levels 2-4 are junior high and levels 2-5 are high school. The continuum at each level is divided into vocabulary/comprehension, which contains 20 objectives, and language arts, which contains 10 objectives. Table B.5 presents the reading continuum objectives.

Table B.5

Reading Continuum Objectives of Prescription Learning

Vocabulary/Comprehension	Language Arts
Root and Base Words	Sentence Elements
Context Clues	Subject-Verb Agreement
Main Idea	Parts of Speech
Compound Words	Capitalization
Word Definitions	Punctuation
Details	Spelling
Syllabication	Use of the Dictionary
Synonyms	Use of References/Library Skills
Sequence	Parts of Book
Drawing Conclusions	Outlining
Inflectional Endings	
Antonyms	
Compare and Contrast	
Suffixes	
Multiple Meanings	
Cause and Effect	
Expressive Language	

The Prescription Learning math curriculum has three levels: primary (K-3), intermediate (5-8) and high school (9-12). The primary level is further subdivided into four continuums; one at each grade level. There are 44, 36 and 37 objectives in the three math levels respectively. The mathematics continuum objectives are displayed in Table B.6.

Table B.6
Mathematics Continuum Objectives of Prescription Learning

Math K-3

Level K Math

1. Matches Numbers to Objects (1-10)
2. Recognizes Number Sequence (1-10)
3. Recognizes the Concepts of More/Less, First/Last
4. Recognizes the Concept of Same and Different
5. Recognizes Repeated Patterns
6. Recognizes the Concept of Size (Large, Small, Taller, etc.)
7. Recognizes Basic Shapes
8. Recognizes Position Words

Level 1 Math

1. Matches Numbers to Objects (1-20)
2. Recognizes Number Sequence (1-100)
3. Recognizes Place Value of Ones and Tens
4. Computes Basic Addition Facts (1-18)
5. Computes Basic Subtraction Facts (1-18)
6. Computes Simple Column Addition
7. Identifies Coins and Their Values
8. Tells Time to the Hour
9. Computes Word Problems in Addition
10. Computes Word Problems in Subtraction

Level 2 Math

1. Recognizes Number Sequence (1-100)
2. Computes Basic Addition Facts (1-18)
3. Computes Basic Subtraction Facts (1-18)
4. Computes Column Addition - No Regrouping
5. Computes 2-digit Subtraction - with Regrouping
6. Computes 2-digit Addition - with Regrouping
7. Recognizes Place Value to Hundreds
8. Recognizes the Fractions 1/2 and 1/4
9. Computes Word Problems in Addition
10. Computes Word Problems in Subtraction
11. Tells Time to the Half Hour
12. Identifies the Operation (+ or -) to Solve a Word Problem

Level 3 Math

1. Recognizes Number Sequence 1-1000
2. Adds 3-digit Numbers - with Regrouping
3. Subtracts 3-digit Numbers - with Regrouping
4. Computes Column Addition - with Regrouping
5. Computes Basic Multiplication Facts
6. Computes Basic Division Facts
7. Identifies Place Value to Thousands
8. Recognizes the Fractions 1/2, 1/4, 1/3, 1/5
9. Recognizes Measurement Using Calendar, Thermometer, Inches, Feet, Yards
10. Adds and Subtracts Using Money
11. Computes Word Problems (4 Operations)
12. Tells Time to the Quarter Hour
13. Recognizes and Uses the Symbols =, -, x, ÷
14. Identifies the operations (=, -, x, or ÷) to Solve a Word Problem

Mathematics Continuum Objectives of Prescription Learning (continued)

Math 4-8

Description

Place Value
Reading and Writing Numerals
Rounding Numerals
Concept and Basic Facts - Addition
Addition - No Regrouping
Concept and Basic Facts - Subtraction
Subtraction - With Regrouping
Addition - Three or More Addends
Concept and Basic Facts - Multiplication
One-digit Multipliers
Two or More Digit Multipliers
Concept and Basic Facts - Division
One-digit Divisors
Two or More Digit Divisors
Multiplication - Factors with Zero
Concept and Techniques of Problem Solving
Solve One-Step Word Problems - Whole Numbers
Solve Two-Step Word Problems - Whole Numbers
Concept of Fractions
Add and Subtract Like Fractions
Add and Subtract Unlike Fractions
Concept of Decimals
Add and Subtract Mixed Numbers
Add and Subtract Decimals
Multiply Fractions
Divide Fractions
Multiply Decimals
Divide Decimals
Identifies English Units of Measurement
Identifies Metric Units of Measurement
Solves Problems Involving Standard Units of Measure
Solves Problems Involving Time and Temperature
Differentiates Between Geometric Shapes
Solves Problems Involving Geometric Principles

Math 9-12

Description

Concept and Basic Facts - Addition
Addition - No Regrouping
Concept and Basic Facts - Subtraction
Subtraction - No Regrouping
Addition - With Regrouping
Subtraction - With Regrouping
Addition - Three or More Addends
Concept and Basic Facts - Multiplication
One-digit Multipliers
Two or More Digit Multipliers
Concept and Basic Facts - Division
One-digit Divisors
Two or More Digit Divisors
Multiplication - Factors with Zero
Concept and Techniques of Problem Solving
Solve Two-Step Word Problems - Whole Numbers
Concept of Fractions
Add and Subtract Like Fractions
Add and Subtract Unlike Fractions
Concept of Decimals
Add and Subtract Mixed Numbers
Add and Subtract Decimals
Multiply Fractions
Divide Fractions
Multiply Decimals
Divide Decimals
Concept of Percents
Ratios and Proportions
Percent Equations
Solve Real World Problems - Mixed Operations
Identifies Metric Units of Measurement
Solves Problems Involving Standard Units of Measure
Solves Problems Involving Time and Temperature
Differentiates Between Geometric Shapes
Solves Problems Involving Geometric Principles
Solve Real World Problems - Geometry and Measurement

DESCRIPTION OF RADIO SHACK CURRICULUM

Three schools in the CAI study used the Radio Shack K-8 Math Program. K-8 Math consists of a series of ten computer programs in BASIC which provide drill and practice exercises in basic mathematical operations.

Part I provides a horizontal problem format for grades K-3, which includes number concepts for Kindergarten, and addition and subtraction for grades 1 and 2. Part II presents a vertical problem format for addition and subtraction in grades 1 and 2, and adds multiplication and division for grades 3 through 8. Table B.7 describes the K-8 Mathematics curriculum.

Table B.7

Organization of the K-8 Math Curriculum

Grade	Curriculum Content	Format
K	Number Concepts	Horizontal
1,2	Number Concepts, Addition, Subtraction	Horizontal, Vertical
3	Addition and Subtraction	Horizontal, Vertical
4,5,6,7,8	Addition, Subtraction, Multiplication, Division	Vertical

The overall program contains three instructional modes: a placement mode, an exercise mode and a test mode.

The placement mode determines a student's most appropriate beginning grade and lesson level. The teacher estimates a starting lesson by examining the K-8 Math curriculum summaries. Students are moved back and forward through sample problems in selected lessons until they miss one or more problems on two successive levels. The program then recommends a suitable placement for the student.

Students continue through the drill and practice exercises in a progressive, self-paced manner. The teacher can select a fixed number of problems for students to work on or can choose to have students work as many problems as possible within a timed session. The Manual Parameter Input feature allows teachers to set up their own problems in addition to those provided by the K-8 curriculum.

In addition and subtraction, students are given two chances to correctly solve a problem. After the second wrong answer, the computer displays the correct response. For multiplication and division, students have two chances to correctly respond to each digit; when the correct one appears on the screen, the student finishes the problem or moves on to the next one.

Graphic reinforcement for K-3 and verbal textual reinforcement for 4-8 is given for correct answers (though this feature may be skipped by pressing any key after entering a response). Students are informed of incorrect responses. A time-out function provides verbal promptings to students who do not respond within 15 seconds of screen presentation of a problem. Cursors cue students in those problems which require regrouping, e.g., carrying in addition, and borrowing in subtraction. In the advanced lessons, from 61 onwards, cuing is an optional function.

Students are automatically moved on in the lessons or held back based on their scores. A summary of the number of problems attempted, number and percent of correct answers and average response time is presented at the end of each lesson. This information may be transferred to individual student record sheets which are provided with the curriculum materials.

The test mode allows the teacher to evaluate students at any time. To test, a teacher selects as many problems as he/she wishes from a lesson, and students complete them without prompting and without knowing which are correct or incorrect. A final report gives the number of problems worked, percent correct and average response time.

A comprehensive teaching guide is provided which contains Lessons Content Summaries describing the basic curriculum, Master Levels which present criteria for promotion among the levels, and Program Summaries which describe operations, format and special features by subject matter.

APPENDIX C:

Curriculum Match Between-Computer Based Instructional Programs and the Portland Achievement Levels Tests Goals

- CCC Curriculum
- Milliken Math
- Radio Shack K-8 Math
- Prescription Learning

Any interpretation of relationships between CAI programs and Portland students' basic skills achievement gains must take into consideration the issue of curriculum alignment: the match of skills taught in CAI with skills measured on the Portland Achievement Level Tests. CAI programs, like other instructional media, can be expected to contribute most effectively to measurable achievement gains if they address the goals against which achievement is defined and measured. Similarly, measures of time spent on a task are most meaningful if the task being timed is well-defined and clearly related to stated goals.

Portland Achievement Levels Tests are designed to measure District-adopted basic skills goals. The summative outcome of these goals is to impart to students literate, effective functioning with language and mathematics. The tests do not directly measure student achievement of prerequisity, formative or instrumental learnings such as knowledge of vowel sounds or the ability to diagram sentences. In addition, the goals of Portland's basic skills curriculum and testing programs extend into areas not conventionally considered "basic" by developers of instructional materials aimed at remedial or low-achieving students; for example, the mathematics goal areas of geometry, statistics/probability and problem solving, and the reading goals of interpretive and evaluative comprehension.

The following charts illustrates the match between the computer-based curricula and the goals and subgoals of the Portland Achievement Levels Tests. The computer-based program lessons were tallied to match the mathematics, reading and language usage goals and subgoals of the Portland Achievement Levels Tests.

CCC and Prescription Learning programs for reading and language usage and CCC, Milliken, Prescription Learning and Radio Shack programs for mathematics were included in the matching process. Random House's language usage program and Milliken reading and language usage programs were not included because the available curriculum summaries did not provide sufficient detail to accurately describe lessons in terms of the Portland Achievement Levels Tests goals.

Each lesson of Prescription Learning and of the CAI curriculum summaries was tallied in reference to both major Portland Achievement Levels Tests goals and subgoals. For example, for Mathematics Goal 1(A), One and Two Digit Regrouping, CCC has a 46. This means that 46 lessons in CCC's curriculum were judged to address Goal 1(A). The task was accomplished by two independent raters for each subject area. Discrepancies were referred to a third party curriculum specialist for guidance in identifying the more appropriate goals match. Because many lessons were broadly described in the program outlines, they were tallied to the major goal heading and not associated with specific subgoals.

Mathematics

Mathematics lessons fom CCC, Milliken, Prescription Learning and Radio Shack were matched with the Portland Achievement Levels Test goals. All four programs include fairly extensive coverage of Math Goals 1 (Addition of Whole Numbers), 2 (Subtraction of Whole Numbers), 3 (Multiplication of Whole Numbers), 4 (Division of Whole Numbers), 5 (Whole Number Numeration), and 13 (Problem Solving).

The remaining Goals 6-12 are covered inconsistently by the programs; Goal 6 (Rational Number Numeration), is briefly included in CCC, Milliken and Prescription Learning; Goal 7 (Computation with Fractions) is extensively covered in Prescription Learning but only slightly by CCC and Milliken; Goal 8 (Computations with Decimals and Percent) is extensively covered by Milliken and briefly included by CCC and Prescription Learning. For Goal 9 (Geometry), only Milliken and Prescription Learning present lessons which match the goal; only CCC and Prescription Learning include lessons for Goal 10 (Measurement). Radio Shack includes no lessons on Goals 6-12 inclusively; Goals 11 (Graphs) and 12 (Word Problems) are not covered in any of the four programs.

Reading

Both CCC and Prescription Learning reading programs provide lessons on each of the four Reading goals. While the goals and subgoals of 1 (Word Meaning) and 2 (Literal Comprehension) are more extensively covered than Goal 3 (Interpretive Comprehension) and Goal 4 (Evaluate Comprehension), nearly half of the entire reading curriculum for both programs emphasizes Goal 1 (Word Meaning), exclusively.

Goal 3 (Interpretive Comprehension) and Goal 4 (Evaluate Comprehension) are less well represented. The matching process did not identify any CCC or Prescription Learning lessons related to Goal 3(4) (Summarize and Synthesize), nor to Goal 4(5) (Detect Bias, Underlying Assumptions).

While Goal 2(2) (Interpret Directions), is not tallied on the chart, it seems reasonable to assume that this particular goal is met by the regular implementation of Prescription Learning and CCC which involves students in continuing interpretation of directions to participate in the curriculum.

Language Usage

Sixty percent of the CCC Language Usage lessons and 90% of the Prescription Learning Language Usage lessons emphasize Goal 2 (Basic Grammar). Of the 14 subgoals under Goal 2, CCC includes lessons on all except, A) (Language Units), and L) (Pronoun Antecedent Agreement). Prescription Learning, while extensively covering the general Goal 2 (Basic Grammar), includes specific lessons on only three subgoals.

CCC offers lessons on only three of the 10 subgoals associated with Goal 1 (Sentence and Paragraph Structure); on four of five subgoals for Goal 3 (Punctuation), and four of five subgoals for Goal 4 (Capitalization). Prescription Learning does not include lessons on Goals 1 (Sentence and Paragraph Structure), 3 (Punctuation), and 4 (Capitalization).

For Goal 5 (Spelling), Prescription Learning emphasizes one of nine subgoals--(H) (Contractions). CCC includes lessons on the three subgoals (C) (Form Plurals), (G) (Abbreviations), and (H) (Contractions).

Goal 6 (Writing), is the least represented of the Prescription Learning and CCC Language Usage curricula. Prescription Learning includes only seven lessons on subgoal (A) (Choosing Appropriate Language) and CCC includes only seven lessons on subgoal (F) (Make Revisions, Edit).

Math Goals and Subgoals

	Number of Lessons by Software Program			
	CCC	MILLIKEN	P.L.	RADIO SHACK
Goal 1: Addition of Whole Numbers	(73)	(30)	(286) 72*	(124) 36*
A. One and two digit, no regrouping.	46	13	120	50
B. Three digit, no regrouping.	3	1	16	8
C. Two digit, regrouping.	12	8	41	12
D. Three and four digit, regrouping.	12	8	37	18
Goal 2: Subtraction of Whole Numbers	(65)	(29)	(277) 122*	(109) 25*
A. One and two digit, no regrouping.	27	10	73	46
B. Three digit, no regrouping.	4	1	23	7
C. Two and three digit, regrouping.	22	12	38	5
D. Four and five digit, regrouping.	12	6	21	26
Goal 3: Multiplication of Whole Numbers	(54)	(25)	(295) 191*	(92) 28*
A. One, two, and three digit by one digit.	36	14	43	47
B. Two, three, and four digit by two digit.	18	9	37	13
C. Two, three, and four digit by three digit.	0	2	24	4
Goal 4: Division of Whole Numbers	(30)	(43)	(308) 182*	(42) 9*
A. One, two, and three digit dividend, one digit divisor, no remainder.	16	25	55	9
B. Two, three, and four digit dividend, two digit divisor, no remainder.	6	1	46	9
C. Two, three, and four digit dividend, one and two digit divisor, remainders.	8	17	12	9
D. Four and five digit dividend, two and three digit divisor, remainders.	--	--	13	6
Goal 5: Whole Number Numeration	(59) 7	(9)	(239) 130*	(27)
A. Order of numbers under ten; counting.	30	9	3	14
B. More and less.	6	--	6	
C. Grouping by tens and ones; place value.	2	--	8	7
D. Order of two digit numbers.	--	--	5	2
E. Expanded notation; place value.	8	--	30	2

( ) TOTAL FOR GOAL
* TOTAL INCLUDES LESSONS WITH NO SPECIFIC SUBGOALS

Math Goals and Subgoals (continued)

	Number of Lessons by Software Program			
	CCC	MILLIKEN	P.L.	RADIO SHACK
Goal 5: Whole Number Numeration (continued)				
F. Order of three digit numbers.	--	--	9	--
G. Renaming numbers, two and three digit.	2	--	--	--
H. Reading/writing numerals to 1,000.	6	--	8	--
I. Estimating sums.	--	--	--	--
J. Reading/writing numerals to 1,000.	--	--	8	2
K. Rounding numbers.	5	--	7	--
L. Estimating differences.	--	--	--	--
M. Numeration through millions.	--	--	17	--
N. Order numbers with exponents.	--	--	3	--
O. Renaming including scientific notation.	--	--	1	--
P. Prime factors.	--	--	4	--
Goal 6: Rational Number Numeration	(30)	(19)	(137) 65*	--
A. Picture to fraction.	--	--	--	--
B. Ordering, comparing, renaming, representing.	15	11	35	--
B.1 Fractions to hundredths.				
B.2 Decimals to hundredths.				
B.3 Fraction to/from fraction.				
B.4 Decimal to/from decimal.				
B.5 Fraction to/from decimal to thousandths.				
C. Ratios and percents.	--	4	23	--
D. Finding common denominator.	4	--	--	--
E. Fractions to/from decimals to/from percent.	11	3	10	--
F. Ratio and proportion.	--	--	3	--
G. Place value to right of decimal point.	--	1	--	--
H. Scientific notation.	--	--	1	--
Goal 7: Computation with Fractions	(30)	(20)	(351) 6*	--
A. Add/subtract fractions.	16	9	84	--
B. Add mixed numbers, like denominators.	2	--	30	--
C. Subtract mixed numbers, like denominators.	2	--	59	--
D. Add/subtract mixed numbers, unlike denominators.	--	8	41	--

Math Goals and Subgoals (continued)

	Number of Lessons by Software Program			
	CCC	MILLIKEN	P.L.	RADIO SHACK
Goal 7: Computation with Fractions (continued)				
E. Multiply mixed numbers, like and unlike denominators.	5	--	91	--
F. Divide mixed numbers, like and unlike denominators.	5	3	40	--
Goal 8: Computation with Decimals and Percent	(26)	(39)	(263) 33*	(4)
A. Add/subtract decimals to hundredths.	13	11	103	--
B. Add/subtract/multiply decimals to thousandths.	7	13	85	--
C. Add/subtract/multiply percents.	1	8	1	--
D. Divide with decimals and percents.	5	7	41	4
E. Estimate computations, mixed decimals, and percents.	--	--	--	--
Goal 9: Geometry	(2)	(25)	(40)	--
A. Simple shapes (square, triangle, etc.).	--	--	--	--
B. Number of sides; concepts "inside," "closed figure."	--	--	--	--
C. Form constancy.	--	--	--	--
D. Compare shapes/sizes.	--	--	--	--
E. Common two-dimensional figures.	--	--	7	--
F. Find perimeter, all dimensions given.	--	--	4	--
G. Common three-dimensional figures.	--	--	4	--
H. Concept of area.	--	--	2	--
I. Parts of a circle.	--	--	4	--
J. Shapes and angles.	--	--	--	--
K. Congruent shapes; concept "congruence."	--	--	--	--
L. Parallel and intersecting lines.	--	--	--	--
M. Perimeter of polygons.	--	8	--	--
N. Area and volume.	2	17	19	--
O. Parallel and perpendicular lines.	--	--	--	--
P. Angle classification.	--	--	--	--
Q. Congruent figures.	--	--	--	--
R. Lines, line segments, angles.	--	--	--	--
S. Congruent and similar figures.	--	--	--	--

Math Goals and Subgoals (continued)

	Number of Lessons by Software Program			
	CCC	MILLIKEN	P.L.	RADIO SHACK
Goal 10: Measurement	(40)	--	(27)	--
A. Length.	--	--	--	--
B. Time.	5	--	11	--
C. Money.	10	--	16	--
D. Temperature.	--	--	--	--
E. Capacity (English).	3	--	--	--
F. Mass (metric).	--	--	--	--
G. Weight.	--	--	--	--
H. Conversions within English systems.	2	--	--	--
I. Conversions within metric systems.	8	--	--	--
J. Comparisons, English and metric.	--	--	--	--
K. Operations on units of measurement.	12	--	--	--
L. Select appropriate unit.	--	--	--	--
Goal 11: Graphs	--	--	(3)	--
A. Interpret graphs.	--	--	3	--
B. Read charts and tables.	--	--	--	--
C. Probability.	--	--	--	--
D. Statistics.	--	--	--	--
Goal 12: Word Problems	--	--	(2)	--
A. Counting.	--	--	--	--
B. Simple addition/subtraction.	--	--	--	--
C. Multiplication.	--	--	--	--
D. Division.	--	--	--	--
E. One or more steps.	--	--	--	--
F. More than one step; factors, percent.	--	--	--	--
G. Measurement/computation applications; more than one step.	--	--	--	--
Goal 13: Problem Solving	(115)	(46)	(158)	(47)
A. Recognize patterns.	--	--	--	2
B. Select operation.	--	--	--	--
C. Number sequences.	26	--	--	10

Math Goals and Subgoals (continued)

	Number of Lessons by Software Program			
	CCC	MILLIKEN	P.L.	RADIO SHACK
D. Geometric sequences.	--	--	--	--
E. Attribute.	--	--	--	--
F. Reasoning skills.	--	--	--	--
G. Comparison.	--	--	--	--
H. Extension of patterns.	--	--	--	4
I. Number and geometric patterns.	--	--	--	--
J. Properties of operations.	20	12	135	28
K. Logic and reasoning.	--	--	--	--
L. Number sentences.	49	13	23	3
M. Operations on integers.	20	21	--	--

Reading Goals and Subgoals

	Number of lessons by Software Program	
	CCC	PL
Goal 1: Word Meaning	(160) 67*	(517)
1. Use context clues.	--	50
2. Use synonyms, antonyms, homonyms.	31	123
3. Use component structures.	63	309
4. Interpret multiple meanings.	9	35
Goal 2: Literal Comprehension	(107) 28*	(314) 65*
1. Recall details.	28	58
2. Interpret directions.	--	--
3. Sequence details.	4	36
4. Classify facts.	39	30
5. Recall stated main idea.	8	125
Goal 3: Interpretive Comprehension	(40)	(76)
1. Draw inferences.	29	42
2. Recognize cause-effect relationships.	11	24
3. Predict events.	--	10
4. Summarize, synthesize.	--	--
Goal 4: Evaluate Comprehension	(45) 29*	(159)
1. Distinguish fact and opinion.	9	16
2. Recognize elements of persuasion, evaluation accuracy/merit.	17	--
3. Evaluate internal and external validity.	--	23
4. Evaluate conclusions, resolutions.	--	120
5. Detect bias, underlying assumptions.	--	--

( ) AGGREGATE NUMBER OF LESSONS PER GOALS, SUBGOALS

(*) NUMBER OF LESSONS PER GOAL UNASSOCIATED
WITH SPECIFIC SUBGOAL

-- NO LESSONS TO ASSOCIATE WITH GOALS/SUBGOALS

Language Usage Goals and Subgoals

	Number of Lessons by Software Program	
	CCC	PL
Goal 1: Sentence and Paragraph Structure	(51)	--
A. Word order.	--	--
B. Complete/incomplete sentences.	6	--
C. Write complete sentences.	30	--
D. Questions, statements, and directions/commands.	--	--
E. Parts of sentence.	15	--
F. Sentence patterns (N-V, etc.).	--	--
G. Sentence structures (simple, etc.).	--	--
H. Types of phrases.	--	--
I. Types of clauses.	--	--
J. Paragraph form.	--	--
Goal 2: Basic Grammar	(450)	(365)
A. Language units (letter, word, sentence, etc.).	--	--
B. Singular/plural nouns.	20	108
C. Regular/irregular noun forms.	36	--
D. Possessive nouns.	14	--
E. Regular past tense verbs.	3	59
F. Irregular verbs.	55	--
G. Distinguish verb tenses.	21	198
H. Present/past participles.	46	--
I. Positive, comparative, superlative adjectives.	36	--
J. Positive, comparative, superlative adverbs.	37	--
K. Pronoun forms/uses.	64	--
L. Pronoun and antecedent agreement.	--	--
M. Parts of speech.	16	--
N. Subject-verb agreement.	102	--
Goal 3: Punctuation	(99)	--
A. End punctuation.	18	--
B. Commas.	41	--
C. Linking punctuation.	--	--
D. Enclosing punctuation.	20	--
E. Apostrophes for possessives.	20	--

Language Usage Goals and Subgoals (continued)

	Number of Lessons by Software Program CCC	PL
Goal 4: Capitalization	(64)	--
A. Beginning capitalization.	16	--
B. Titles.	6	--
C. Proper nouns.	37	--
D. Proper adjectives.	--	--
E. Pronoun I.	5	--
Goal 5: Spelling	(76)	(39)
A. Likenesses/differences.	--	--
B. Spelling common words.	--	--
C. Form plurals.	20	--
D. Spell common prefixes.	--	--
E. Spell common suffixes.	--	--
F. Syllabication.	--	--
G. Abbreviations.	19	--
H. Contractions.	37	39
I. Use dictionaries.	--	--
Goal 6: Writing	(7)	(7)
A. Choose appropriate language.	--	7
B. Select/pattern sentences.	--	--
C. Organize material in sequence.	--	--
D. Develop a theme.	--	--
E. Know editing requirements.	--	--
F. Make revisions, edit.	7	--

APPENDIX D:

Tables Presenting Standard Deviation Means,
GROW and RATE of Growth for CAI Participants by:

- Grade Level and Software
- School and Grade Level

TABLE D.1

Math Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One Year, 1982-83, by Grade Level and Software

Grade/ Software	Deviations of Group Means F 81	S 82	F 82	S 83	Growth F to S GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
Grade 5							
CCC	-.87 (13)	-.84 (13)	-1.33 (13)	-1.21 (13)	.23 (13)	.28 (13)	-.54 (12)
Milliken	--	--	--	--	--	--	--
Radio Shack	-4.10 (10)	-3.83 (10)	-4.74 (11)	-4.27 (11)	.69 (10)	1.07 (11)	-.02 (9)
Grade 6							
CCC	-1.27 (20)	-1.53 (20)	-1.62 (24)	-1.23 (24)	-.84 (20)	1.23 (24)	1.73 (19)
Milliken	-1.44 (15)	-1.96 (15)	-2.11 (15)	-1.81 (15)	-1.69 (15)	.91 (15)	1.58 (14)
Radio Shack	-3.27 (29)	-3.19 (29)	-3.60 (36)	-3.77 (36)	.22 (29)	-.52 (36)	-.47 (28)
Grade 7							
CCC	-3.44 (21)	-2.62 (21)	-2.11 (29)	-2.35 (29)	2.43 (21)	-1.20 (29)	-2.95 (20)
Milliken	-4.72 (1)	-2.73 (1)	--	--	5.94 (1)	--	--
Radio Shack	-2.70 (16)	-2.64 (16)	-3.22 (25)	-3.28 (25)	.14 (16)	-.24 (25)	-1.83 (15)
Grade 8							
CCC	-4.22 (21)	-3.75 (21)	-4.06 (25)	-3.83 (25)	1.54 (21)	1.38 (25)	.14 (20)
Milliken	-2.43 (5)	-2.49 (5)	-3.11 (7)	-2.98 (7)	-.20 (5)	-.58 (7)	.13 (5)
Radio Shack	-4.22 (9)	-3.50 (9)	-4.44 (11)	-3.92 (11)	2.34 (9)	2.12 (11)	-1.36 (9)
Total	-2.83 (160)	-2.65 (160)	-2.98 (196)	-2.88 (196)	.54 (160)	.31 (196)	-.40 (151)

( ) Indicates N

TABLE D.2

Math Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One or Two Years, as at 1982-83, by Grade Level and Software

Grade/ Software	Deviations of Group Means				Growth F to S		
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
Grade 5							
CCC	-.87 (13)	-.84 (13)	-1.33 (13)	-1.21 (13)	.23 (13)	.28 (13)	-.54 (12)
Milliken	--	--	--	--	--	--	--
Radio Shack	-4.10 (10)	-3.83 (10)	-4.74 (11)	-4.27 (11)	.69 (10)	1.07 (11)	-.02 (9)
Grade 6							
CCC	-1.27 (20)	-1.53 (20)	-1.62 (24)	-1.23 (24)	-.84 (20)	1.23 (24)	1.73 (19)
Milliken	-1.44 (15)	-1.96 (15)	-2.11 (15)	-1.81 (15)	-1.69 (15)	.91 (15)	1.58 (14)
Radio Shack	-3.27 (29)	-3.19 (29)	-3.60 (36)	-3.77 (36)	.22 (29)	-.52 (36)	-.47 (28)
Grade 7							
CCC	-3.17 (33)	-2.39 (33)	-2.28 (44)	-2.36 (44)	2.33 (33)	-.37 (44)	-2.37 (32)
Milliken	-4.72 (1)	-2.73 (1)	--	--	5.94 (1)	--	--
Radio Shack	-2.87 (19)	-2.63 (19)	-3.22 (31)	-3.36 (31)	.69 (19)	-.66 (31)	-2.52 (18)
Grade 8							
CCC	-3.43 (37)	-2.88 (37)	-2.96 (46)	-2.99 (46)	1.78 (37)	.12 (46)	-1.26 (35)
Milliken	-2.93 (10)	-2.44 (10)	-2.95 (12)	-2.77 (12)	1.62 (10)	.77 (12)	-1.22 (10)
Radio Shack	-4.35 (13)	-3.75 (13)	-4.42 (15)	-3.93 (15)	1.98 (13)	2.04 (15)	-.83 (13)
Total	-2.85 (200)	-2.57 (200)	-2.86 (247)	-2.80 (247)	.89 (200)	.20 (247)	-.81 (190)

Table D.3

Math Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled Two Years, 1981-83, by Grade Level and Software

Grade/ Software	Deviations of Group Means				Growth F to S		RATE of Growth
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	81-82 to 82-83
Grade 7							
CCC	-1.87 (11)	-2.50 (11)	-2.61 (15)	-2.37 (15)	2.16 (12)	1.24 (15)	-1.42 (12)
Milliken	--	--	--	--	--	--	--
Radio Shack	-2.56 (3)	-3.79 (3)	-3.22 (6)	-3.70 (6)	3.65 (3)	-2.37 (6)	-5.99 (3)
Grade 8							
CCC	-1.85 (17)	-2.54 (17)	-1.64 (21)	-1.99 (21)	2.09 (16)	-1.37 (21)	-3.12 (15)
Milliken	-2.39 (5)	-3.43 (5)	-2.72 (5)	-2.47 (5)	3.43 (5)	1.03 (5)	-2.58 (5)
Radio Shack	-4.31 (4)	-4.67 (4)	-4.37 (4)	-3.94 (4)	1.18 (4)	1.80 (4)	.36 (4)
Total	-2.95 (40)	-2.22 (40)	-2.43 (51)	-2.50 (51)	2.31 (40)	-.23 (51)	-2.39 (39)

Table D.4

Reading Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One Year, 1982-83, by Grade Level and Software

Grade/ Software	Deviations of Group Means				Growth F to S		RATE of Growth
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	81-82 to 82-83
Grade 5							
CCC	-2.10 (20)	-1.75 (20)	-1.84 (26)	-2.19 (26)	1.27 (20)	-1.24 (26)	-1.81 (23)
Milliken	--	--	--	--	--	--	--
Grade 6							
CCC	-4.19 (6)	-3.67 (6)	-2.79 (7)	-2.72 (7)	1.82 (6)	.26 (7)	-1.42 (8)
Milliken	--	--	--	--	--	--	--
Grade 7							
CCC	-1.69 (6)	-1.65 (6)	-1.60 (12)	-1.40 (12)	.36 (6)	.89 (12)	-1.72 (8)
Milliken	-2.93 (6)	-3.09 (6)	-2.61 (7)	-2.45 (7)	-.53 (6)	.70 (7)	-.71 (6)
Grade 8							
CCC	-3.88 (2)	-4.35 (2)	-3.33 (2)	-3.34 (2)	-1.90 (2)	-.01 (2)	1.50 (2)
Milliken	--	--	--	--	--	--	--
Total	-2.57 (40)	-2.35 (40)	-2.06 (54)	-2.16 (54)	.79 (40)	-.27 (54)	-1.45 (47)

Table D.5

Reading Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One or Two Years, as at 1982-83, by Grade Level and Software

Grade/	Deviations of Group Means				Growth F to S		RATE of Growth
Software	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	81-82 to 82-83
Grade 5							
CCC	-1.98 (21)	-1.71 (21)	-1.84 (26)	-2.19 (26)	1.01 (21)	-1.24 (26)	-1.81 (23)
Milliken	--	--	--	--	--	--	--
Grade 6							
CCC	-4.10 (17)	-3.32 (17)	-3.44 (20)	-2.99 (20)	2.44 (17)	1.81 (20)	-1.31 (18)
Milliken	--	--	--	--	--	--	--
Grade 7							
CCC	-3.39 (13)	-2.93 (13)	-2.38 (21)	-2.16 (21)	1.65 (13)	.98 (21)	-1.73 (16)
Milliken	-2.48 (10)	-2.37 (10)	-2.23 (11)	-1.97 (11)	.39 (10)	1.15 (11)	-.52 (10)
Grade 8							
CCC	-4.53 (7)	-4.27 (7)	-3.33 (8)	-3.51 (8)	1.03 (7)	-.25 (8)	.18 (7)
Milliken	--	--	--	--	--	--	--
Total	-3.11 (68)	-2.71 (68)	-2.53 (86)	-2.46 (86)	1.40 (68)	.41 (86)	-1.31 (74)

Table D.6

Reading Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled Two Years, 1981-83, by Grade Level and Software

Grade/	Deviations of Group Means				Growth F to S		
Software	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
Grade 5							
CCC	.42 (1)	-1.00 (1)			-4.25 (1)		--
Milliken	--	--			--		--
Grade 6							
CCC	-4.05 (11)	-3.13 (11)	-3.79 (13)	-3.13 (13)	2.78 (11)	2.64 (13)	-1.23 (10)
Milliken	--	--	--	--	--	--	--
Grade 7							
CCC	-4.84 (7)	-4.04 (7)	-3.42 (9)	-3.18 (9)	2.77 (7)	1.10 (9)	-1.75 (8)
Milliken	-1.80 (4)	-1.28 (4)	-1.58 (4)	-1.14 (4)	1.78 (4)	1.93 (4)	-.23 (4)
Grade 8							
CCC	-4.79 (5)	-4.24 (5)	-3.33 (6)	-3.56 (6)	2.20 (5)	-.33 (6)	-.34 (5)
Milliken	--	--	--	--	--	--	--
Total	-3.90 (28)	-3.21 (28)	-3.33 (32)	-2.98 (32)	2.28 (28)	1.56 (32)	-1.07 (27)

Table D.7

Language Usage Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One Year, 1982-83, by Grade Level and Software

Grade/ Software	Deviations of Group Means				Growth F to S		
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
Grade 5							
CCC	-.06 (5)	-.06 (5)	.01 (7)	-.65 (7)	.04 (5)	-1.84 (7)	-1.34 (5)
Milliken	--	--	--	--	--	--	--
Random House	-2.18 (4)	-2.35 (4)	-3.75 (3)	-4.32 (3)	-.45 (3)	-1.58 (3)	-.60 (3)
Grade 6							
CCC	-3.51 (17)	-3.65 (17)	-3.72 (21)	-2.93 (21)	-.31 (17)	3.35 (21)	1.86 (21)
Milliken	-3.63 (9)	-2.06 (9)	-2.79 (11)	-2.50 (11)	4.44 (9)	1.28 (11)	-2.75 (10)
Random House	--	--	--	--	--	--	--
Grade 7							
CCC	-4.30 (15)	-3.33 (15)	-3.13 (20)	-2.68 (20)	2.30 (15)	1.78 (20)	-1.56 (15)
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Grade 8							
CCC	-5.44 (19)	-3.16 (19)	-3.79 (21)	-3.29 (21)	4.78 (19)	2.24 (21)	-3.01 (20)
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Total	-3.90 (69)	-2.90 (69)	-3.16 (83)	-2.76 (83)	2.30 (69)	1.80 (83)	-1.09 (74)

Table D.8

Language Usage Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One or Two Years, as at 1982-83, by Grade Level and Software

Grade/ Software	Deviations of Group Means				Growth F to S		
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	RATE of Growth 81-82 to 82-83
Grade 5							
CCC	-.06	-.06	.01	-.65	.04	-1.84	-1.34
	(5)	(5)	(7)	(7)	(5)	(7)	(5)
Milliken	--	--	--	--	--	--	--
Random House	-2.18	-2.35	-3.75	-4.32	-.45	-1.58	-.60
	(4)	(4)	(3)	(3)	(4)	(3)	(3)
Grade 6							
CCC	-3.35	-3.38	-3.59	-2.81	-.04	3.31	1.67
	(19)	(19)	(23)	(23)	(19)	(23)	(23)
Milliken	-3.63	-2.06	-2.79	-2.50	4.44	1.28	-2.75
	(9)	(9)	(11)	(11)	(9)	(11)	(10)
Random House	--	--	--	--	--	--	--
Grade 7							
CCC	-4.52	-3.61	-3.46	-2.98	2.14	1.88	-1.28
	(17)	(17)	(22)	(22)	(17)	(22)	(17)
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Grade 8							
CCC	-5.70	-3.42	-4.16	-3.48	4.78	2.90	-2.77
	(22)	(22)	(25)	(25)	(22)	(25)	(23)
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Total	-4.04	-3.01	-3.35	-2.88	2.36	2.05	-1.03
	(76)	(76)	(91)	(91)	(76)	(91)	(81)

Table D.9

Language Usage Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled Two Years, 1981-83, by Grade Level and Software

Grade/ Software	Deviations of Group Means				Growth F to S		RATE of Growth
	F 81	S 82	F 82	S 83	GROW 81-82	GROW 82-83	81-82 to 82-83
Grade 5							
CCC	--	--	--	--	--	--	--
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Grade 6							
CCC	-1.98 (2)	-1.16 (2)	-2.24 (2)	-1.58 (2)	2.23 (2)	2.83 (2)	-.32 (2)
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Grade 7							
CCC	-6.15 (2)	-5.76 (2)	-6.78 (2)	-6.04 (2)	.94 (2)	2.91 (2)	.83 (2)
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Grade 8							
CCC	-7.32 (3)	-5.05 (3)	-6.14 (4)	-4.47 (4)	4.75 (3)	6.38 (4)	-1.20 (3)
Milliken	--	--	--	--	--	--	--
Random House	--	--	--	--	--	--	--
Total	-5.46 (7)	-4.14 (7)	-5.32 (8)	-4.14 (8)	2.97 (7)	4.62 (8)	-.37 (7)

Table D.10

Math Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One Year, 1982-83, by School and Grade Level

	Grade 5			Grade 6			Grade 7			Grade 8			Totals		
School	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE
Abernethy	.56 (5)	1.33 (4)	.61 (4)	--	--	--	--	--	--	--	--	--	.56 (5)	1.33 (4)	.61 (4)
Boise	1.38 (8)	.72 (7)	-1.37 (7)	.10 (10)	1.59 (13)	1.69 (10)	1.08 (12)	-1.94 (21)	-1.95 (12)	1.85 (4)	.30 (5)	.96 (3)	.95 (34)	-.30 (46)	-.42 (32)
James John	.83 (5)	.93 (7)	-.53 (5)	--	-11.14 (1)	--	-1.11 (6)	.98 (15)	.08 (6)	3.20 (6)	2.69 (7)	-2.25 (6)	.98 (17)	.96 (30)	-.92 (17)
Markham	--	--	--	-1.69 (15)	.91 (15)	1.58 (14)	5.94 (1)	--	--	-.20 (5)	.58 (7)	.13 (5)	-.98 (21)	.81 (22)	1.20 (19)
Portsmouth	-1.61 (5)	-.23 (6)	.62 (5)	.34 (4)	-.06 (4)	-.26 (4)	4.39 (8)	-.28 (8)	-5.21 (7)	2.31 (10)	1.95 (12)	-.56 (10)	1.91 (27)	.65 (30)	-1.54 (26)
Tubman	--	--	--	-.37 (35)	.03 (42)	.12 (33)	1.33 (10)	-1.31 (11)	-2.70 (10)	.38 (10)	1.17 (12)	.67 (10)	.08 (55)	.01 (65)	-.31 (53)
Totals	.43 (23)	.64 (24)	-.32 (21)	-.56 (64)	.32 (75)	.68 (61)	1.56 (37)	-.78 (55)	-2.47 (35)	1.50 (35)	1.44 (43)	-.26 (34)	.54 (159)	.30 (197)	-.40 (151)

Table D.11

Math Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One or Two Years, by School and Grade Level

School	Grade 5			Grade 6			Grade 7			Grade 8			Totals		
	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE
Abernethy	.56 (5)	1.33 (4)	.61 (4)	--	--	--	--	--	--	--	--	--	.56 (5)	1.33 (4)	.61 (4)
Boise	1.38 (8)	.72 (7)	-1.37 (7)	.10 (10)	1.59 (13)	1.69 (10)	.84 (16)	-1.97 (25)	-1.84 (16)	1.68 (19)	-1.05 (26)	-2.44 (18)	1.08 (53)	-.71 (71)	-1.30 (51)
James John	.83 (5)	.93 (7)	-.53 (5)	--	-11.14 (1)	--	-1.11 (6)	.98 (15)	.08 (6)	3.20 (6)	2.69 (7)	-2.25 (6)	.98 (17)	.96 (30)	-.92 (17)
Markham	--	--	--	-1.69 (15)	.91 (15)	1.58 (14)	5.94 (1)	--	--	1.62 (10)	.77 (12)	-1.22 (10)	-.13 (26)	.85 (27)	.41 (24)
Portsmouth	-1.61 (5)	-.23 (6)	.62 (5)	.34 (4)	-.06 (4)	-.26 (4)	4.39 (8)	-.28 (8)	-5.21 (7)	2.31 (10)	1.95 (12)	-.56 (10)	1.91 (27)	.65 (30)	-1.54 (26)
Tubman	--	--	--	-.37 (35)	.03 (42)	.12 (33)	2.39 (21)	-.06 (28)	-2.67 (21)	1.15 (15)	1.33 (16)	.58 (14)	.77 (71)	.24 (86)	-.65 (68)
Totals	.43 (23)	.64 (24)	-.32 (21)	-.56 (64)	.32 (75)	.68 (61)	1.81 (53)	-.50 (76)	-2.43 (50)	1.80 (60)	.62 (73)	-1.16 (58)	.89 (199)	.19 (248)	-.81 (190)

Table D.12

Math Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled Two Years, by School and Grade Level

School	Grade 5			Grade 6			Grade 7			Grade 8			Totals		
	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE
Boise	--	--	--	--	--	--	-11.00 (4)	-2.11 (4)	-1.50 (4)	1.64 (15)	-1.37 (21)	-3.12 (15)	1.32 (19)	-1.49 (25)	-2.78 (19)
Markham	--	--	--	--	--	--	--	--	--	3.43 (5)	1.03 (5)	-2.58 (5)	3.43 (5)	1.03 (5)	-2.58 (5)
Tubman	--	--	--	--	--	--	3.31 (11)	.75 (17)	-2.64 (11)	2.71 (5)	1.80 (4)	.36 (4)	3.12 (16)	.95 (21)	-1.84 (15)
Totals	--	--	--	--	--	--	2.46 (15)	.21 (21)	-2.33 (15)	2.21 (25)	-.55 (30)	-2.43 (24)	2.31 (40)	-.23 (51)	-2.39 (39)

Table D.13

Reading Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One Year, 1982-83, by School and Grade Level

	Grade 5			Grade 6			Grade 7			Grade 8			Totals		
School	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE
Boise	2.10 (9)	-.23 (11)	-2.09 (9)	2.51 (5)	1.81 (6)	-1.30 (5)	1.71 (4)	-.60 (8)	-2.27 (4)	--	--	--	2.13 (18)	.14 (25)	-1.91 (18)
Markham	--	--	--	--	--	--	-.58 (7)	.21 (8)	-.80 (7)	--	--	--	-.58 (7)	.21 (8)	-.80 (7)
Portsmouth	.59 (11)	-1.97 (15)	-1.63 (14)	--	--	.04 (2)	-2.35 (2)	3.86 (4)	-1.17 (4)	-1.90 (2)	-.01 (2)	1.50 (2)	-.13 (15)	-.67 (21)	-1.11 (22)
Tubman	--	--	--	-1.64 (1)	-9.05 (1)	-4.92 (1)	--	--	--	--	--	--	-1.64 (1)	-9.05 (1)	-4.92 (1)
Totals	1.27 (20)	-1.24 (26)	-1.81 (23)	1.82 (6)	.26 (7)	-1.42 (8)	-.15 (13)	.62 (20)	-1.29 (15)	-1.90 (2)	-.01 (2)	--	.75 (41)	-.33 (5)	-1.50 (2)

Table D.14

Reading Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One or Two Years, by School and Grade Level

	Grade 5			Grade 6			Grade 7			Grade 8			Totals		
School	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE
Boise	2.10 (9)	-.23 (11)	-2.09 (9)	1.39 (7)	1.55 (8)	-.87 (6)	1.71 (4)	-.60 (8)	-2.27 (4)	.58 (1)	-.32 (1)	-.65 (1)	1.72 (21)	.17 (28)	-1.69 (20)
Markham	--	--	--	--	--	--	-.28 (11)	.78 (12)	-.59 (11)	--	--	--	-.28 (11)	.78 (12)	-.59 (11)
Portsmouth	.19 (12)	-1.97 (15)	-1.63 (14)	3.71 (9)	2.98 (11)	-1.23 (11)	1.02 (8)	2.07 (12)	-1.22 (11)	1.11 (6)	-.24 (7)	.32 (6)	1.44 (35)	.59 (45)	-1.14 (42)
Tubman	--	--	--	-1.64 (1)	-9.05 (1)	-4.92 (1)	6.53 (1)	.56 (1)	-5.27 (1)	--	--	--	2.44 (2)	-4.25 (2)	-5.10 (2)
Totals	1.01 (21)	-1.24 (26)	-.81 (23)	2.44 (17)	1.81 (20)	-1.31 (18)	1.02 (24)	.91 (33)	-1.27 (27)	1.03 (7)	-.25 (8)	.18 (7)	1.37 (69)	.37 (87)	-1.31 (75)

Table D.15

Reading Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled Two Years, by School and Grade Level

School	Grade 5 GROW 81-82	GROW 82-83	RATE	Grade 6 GROW 81-82	GROW 82-83	RATE	Grade 7 GROW 81-82	GROW 82-83	RATE	Grade 8 GROW 81-82	GROW 82-83	RATE	Totals GROW 81-82	GROW 82-83	RATE
Boise	--	--	--	-1.42 (2)	.76 (2)	1.27 (1)	--	--	--	.58 (1)	-.32 (1)	-.65 (1)	-.75 (3)	.40 (3)	.31 (2)
Markham	--	--	--	--	--	--	1.78 (4)	1.93 (4)	-.23 (4)	--	--	--	1.78 (4)	1.93 (4)	-.23 (4)
Portsmouth	-4.25 (1)	--	--	3.71 (9)	2.98 (11)	-1.51 (9)	2.14 (6)	1.17 (8)	-1.24 (7)	2.61 (4)	-.33 (5)	-.27 (4)	2.62 (20)	1.69 (24)	-1.17 (20)
Tubman	--	--	--	--	--	--	6.53 (1)	.56 (1)	-5.27 (1)	--	--	--	6.53 (1)	.56 (1)	-5.27 (1)
Totals	-4.25 (1)	--	--	2.75 (11)	2.64 (13)	-1.23 (10)	2.41 (11)	1.36 (13)	-1.24 (12)	2.20 (5)	-.33 (6)	-.34 (5)	2.28 (28)	1.56 (32)	-1.07 (27)

Table D.16

Language Usage Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One Year, 1982-83, by School and Grade Level

	Grade 5			Grade 6			Grade 7			Grade 8			Totals		
School	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE
Boise	2.91 (6)	-2.02 (8)	-3.89 (6)	.45 (3)	4.60 (5)	2.53 (4)	.96 (2)	.03 (4)	-1.11 (2)	--	--	--	1.89 (11)	.41 (17)	-1.29 (12)
James John	-.45 (4)	-1.58 (3)	-.60 (3)	--	--	--	--	--	--	--	--	--	-.45 (4)	-1.58 (3)	-.60 (3)
Markham	--	--	--	4.44 (9)	1.28 (11)	-2.75 (10)	--	--	--	--	--	--	4.44 (9)	1.28 (11)	-2.75 (10)
Portsmouth	--	--	--	--	--	--	4.64 (5)	3.08 (8)	-3.15 (6)	4.84 (17)	2.71 (19)	-2.73 (18)	4.79 (22)	2.82 (27)	-2.83 (24)
Tubman	--	--	--	-.48 (14)	2.96 (16)	1.71 (17)	1.17 (8)	1.35 (8)	-.32 (7)	4.34 (2)	-2.25 (2)	-5.54 (2)	.47 (24)	2.06 (26)	.61 (26)
Totals	1.57 (10)	-1.90 (11)	-2.80 (9)	1.33 (26)	2.64 (32)	.37 (31)	2.30 (15)	1.78 (20)	-1.56 (15)	4.78 (19)	2.24 (21)	-3.01 (20)	2.51 (70)	1.74 (84)	-1.29 (75)

Table D.17

Language Usage Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled One or Two Years, by School and Grade Level

	Grade 5			Grade 6			Grade 7			Grade 8			Totals		
School	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE
Boise	2.91 (6)	-2.02 (8)	-3.89 (6)	1.20 (5)	4.10 (7)	1.58 (6)	.96 (2)	.03 (4)	-1.11 (2)	--	--	--	1.95 (13)	.67 (19)	-1.15 (14)
James John	-.45 (4)	-1.58 (3)	-.60 (3)	--	--	--	--	--	--	--	--	--	-.45 (4)	-1.58 (3)	-.60 (3)
Markham	--	--	--	4.44 (9)	1.28 (11)	-2.75 (10)	--	--	--	--	--	--	4.44 (9)	1.28 (11)	-2.75 (10)
Portsmouth	--	--	--	--	--	--	4.64 (5)	3.08 (8)	-3.15 (6)	4.84 (17)	2.71 (19)	-2.73 (18)	4.79 (22)	2.82 (27)	-2.83 (24)
Tubman	--	--	--	-.48 (14)	2.96 (16)	1.71 (17)	1.12 (10)	1.66 (10)	-.06 (9)	4.59 (5)	3.50 (6)	-2.94 (5)	.95 (29)	2.66 (32)	.44 (31)
Totals	1.57 (10)	-1.90 (11)	-2.80 (9)	1.40 (28)	2.65 (34)	.33 (33)	2.14 (17)	1.88 (22)	-1.28 (17)	4.78 (22)	2.90 (25)	-2.77 (23)	2.55 (77)	1.99 (92)	-1.22 (82)

Table D.18

Language Usage Standard Deviation Means Showing Growth and RATE of Growth for CAI Students Enrolled Two Years, by School and Grade Level

School	Grade 5			Grade 6			Grade 7			Grade 8			Totals		
	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE	GROW 81-82	GROW 82-83	RATE
Boise	--	--	--	2.32 (2)	2.83 (2)	-.32 (2)	--	--	--	--	--	--	2.32 (2)	2.83 (2)	-.32 (2)
Tubman	--	--	--	--	--	--	.94 (2)	2.91 (2)	.83 (2)	4.75 (3)	6.38 (4)	-1.20 (3)	3.23 (5)	5.22 (6)	-.39 (5)
Totals	--	--	--	2.32 (2)	2.83 (2)	-.32 (2)	.94 (2)	2.91 (2)	.83 (2)	4.75 (3)	6.38 (4)	-1.20 (3)	2.97 (7)	4.62 (8)	-.37 (7)

APPENDIX E:

Effects of Prescription Learning Programs by School

EFFECTS OF PRESCRIPTION LEARNING PROGRAM

Data for Prescription Learning students were examined by school. Tables E.1, E.2 and E.3 show the deviation scores for Prescription Learning students in mathematics, reading and language usage by school.

GROW*: The results for individual schools show a wide range of gains for students who were in the program for one year in 1982-83. In math, the results showed that three schools (Clarendon, Buckman and Whitaker) made positive, significant gains; one school (Sellwood) made a positive gain, approaching significance; three schools (Beach, Ockley Green and Kellogg) made no gain or loss; and one school (George) made a non-significant, negative gain. Specifically, the reading results show: one school (Clarendon) made a significant gain beyond the District average; three schools (Kelly, Kellogg and Ockley Green) made non-significant, positive gains; five schools (Buckman, Meek, Beach, George and Sellwood) showed no gain or loss; and one school (Whitaker) had a non-significant, negative gain.

In language usage, the results showed that three schools (Clarendon, Buckman and George) made positive, significant gains; two schools (Sellwood and Ockley Green) made positive gains approaching significance; two schools (Kelly and Beach) made non-significant, positive gains; two schools (Whitaker and Kellogg) made no gain or loss; and one school (Meek) showed a non-significant, negative loss.

RATE**: The results for individual schools also show a wide range of gains in the change in achievement growth made in 1982-83 compared to 1981-82. In mathematics, only one school (Whitaker) had a sufficient number of students on which to report results; it showed a non-significant, positive gain. In reading, three schools (Ockley Green, Kellogg and Meek) showed a non-significant, positive gain; two schools (Whitaker and Kelly) showed no gain or loss; and one school (Sellwood) had a non-significant, negative gain. In language, one school (George) made a positive, significant gain; one school (Kelly) made a gain approaching significance; one school (Ockley Green) made a non-significant, positive gain; two schools (Whitaker and Sellwood) showed no gain or loss; one school (Kellogg) showed a non-significant, negative gain; and one school (Meek) showed a negative, significant gain.

Table E.1
Math Standard Deviation Means for Prescription Learning Students by Years in Program by School

School	Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Applegate	-2.91	-2.91	-4.23	-3.49	-0.42	1.71	-0.27
	(3)	(3)	(4)	(4)	(3)	(4)	(3)
Beach	-2.32	-2.75	-2.61	-2.36	-1.29	0.44	0.19
	(16)	(16)	(36)	(36)	(16)	(36)	(16)
Buckman	-2.42	-2.74	-2.72	-2.03	-0.41	2.17	2.90
	(13)	(13)	(30)	(30)	(13)	(30)	(12)
Clarendon	-3.96	-3.72	-3.88	-2.19	0.44	3.54	0.91
	(6)	(6)	(24)	(24)	(6)	(24)	(6)
George - Total	-3.43	-2.58	-2.87	-3.01	2.07	0.01	-2.03
	(39)	(39)	(55)	(55)	(39)	(55)	(38)
One Year	-3.85	-2.81	-2.76	-3.16	2.38	-0.78	-3.28
	(25)	(25)	(37)	(37)	(25)	(37)	(24)
Two Year	-2.70	-2.16	-3.11	-2.69	1.53	1.62	0.10
	(14)	(14)	(18)	(18)	(14)	(18)	(14)
Ockley Green - Total	-3.52	-3.48	-3.71	-3.36	0.14	1.66	0.77
	(54)	(54)	(66)	(66)	(54)	(66)	(54)
One Year	-3.17	-3.21	-3.35	-3.30	-0.12	0.21	0.48
	(23)	(23)	(30)	(30)	(23)	(30)	(23)
Two Year	-3.77	-3.67	-4.01	-3.41	0.33	2.87	0.99
	(31)	(31)	(36)	(36)	(31)	(36)	(31)
Kellogg - Total	-2.82	-3.09	-3.04	-2.86	-0.85	1.04	1.29
	(47)	(47)	(42)	(42)	(47)	(42)	(38)
One Year	-2.34	-2.65	-2.80	-2.86	-0.96	-0.09	0.92
	(22)	(22)	(22)	(22)	(22)	(22)	(19)
Two Year	-3.23	-3.48	-3.31	-2.86	-0.75	2.29	1.65
	(25)	(25)	(20)	(20)	(25)	(20)	(19)
Sellwood - Total	-3.00	-2.93	-3.49	-3.27	0.20	0.52	0.15
	(24)	(24)	(38)	(38)	(24)	(38)	(23)
One Year	-3.38	-2.88	-4.02	-3.42	1.48	1.80	1.27
	(9)	(9)	(22)	(22)	(9)	(22)	(9)
Two Year	-2.77	-2.96	-2.76	-3.07	-0.56	-1.23	-0.57
	(15)	(15)	(16)	(16)	(15)	(16)	(14)
Whitaker - Total	-3.74	-3.50	-3.38	-3.02	0.77	1.67	0.15
	(43)	(43)	(50)	(50)	(43)	(50)	(42)
One Year	-3.45	-3.38	-3.20	-2.72	0.22	2.23	1.06
	(27)	(27)	(35)	(35)	(27)	(35)	(27)
Two Year	-4.21	-3.70	-3.82	-3.73	1.70	0.36	-1.48
	(16)	(16)	(15)	(15)	(16)	(15)	(15)

Table E.2
Reading Standard Deviation Means for Prescription Learning Students by Years in Program by School

School	Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Applegate	-3.09	-2.86	-3.27	-2.85	0.77	1.34	0.02
	(8)	(8)	(14)	(14)	(8)	(14)	(8)
Beach	-1.56	-1.66	-1.50	-1.56	-0.33	-0.39	-0.81
	(11)	(11)	(27)	(27)	(11)	(27)	(12)
Buckman	-4.10	-4.34	-2.88	-2.83	-0.75	-0.03	-0.40
	(11)	(11)	(33)	(33)	(11)	(33)	(23)
Clarendon	-3.56	-3.79	-3.91	-1.97	-0.70	5.21	2.11
	(10)	(10)	(32)	(32)	(10)	(32)	(15)
George - Total	-2.98	-3.14	-3.74	-3.67	-0.49	0.28	1.12
	(36)	(36)	(49)	(49)	(36)	(49)	(36)
One Year	-2.78	-3.04	-3.68	-3.83	-0.79	-0.47	0.12
	(23)	(23)	(32)	(32)	(23)	(32)	(24)
Two Year	-3.34	-3.32	-3.85	-3.37	0.02	1.68	3.11
	(13)	(13)	(17)	(17)	(13)	(17)	(12)
Ockley Green - Total	-3.23	-3.15	-3.09	-2.84	0.40	1.05	0.67
	(60)	(60)	(70)	(70)	(60)	(70)	(62)
One Year	-2.60	-2.77	-2.84	-2.62	-0.49	0.87	1.49
	(30)	(30)	(37)	(37)	(30)	(37)	(32)
Two Year	-3.85	-3.53	-3.36	-3.09	1.28	1.25	-0.20
	(30)	(30)	(33)	(33)	(30)	(33)	(30)
Kelly	-3.62	-3.50	-3.37	-2.91	0.39	1.58	0.30
	(28)	(28)	(47)	(47)	(28)	(47)	(30)
Kellogg - Total	-2.99	-3.37	-2.98	-2.86	-1.41	0.45	1.29
	(50)	(50)	(57)	(57)	(50)	(57)	(50)
One Year	-2.57	-2.92	-3.13	-2.88	-1.35	0.96	1.45
	(25)	(25)	(30)	(30)	(25)	(30)	(26)
Two Year	-3.41	-3.81	-2.81	-2.84	-1.46	-0.11	1.11
	(25)	(25)	(27)	(27)	(25)	(27)	(24)
Meek	-1.84	-2.49	-2.29	-2.31	-1.97	-0.08	0.80
	(24)	(24)	(37)	(37)	(24)	(37)	(25)
Sellwood - Total	-3.37	-3.13		-3.61	0.82	-0.44	-0.59
	(41)	(41)		(55)	(41)	(55)	(49)
One Year	-3.49	-3.12	-3.72	-3.83	1.26	-0.50	-1.09
	(19)	(19)	(31)	(31)	(19)	(31)	(28)
Two Year	-3.26	-3.14	-3.26	-3.34	0.45	-0.38	0.07
	(22)	(22)	(24)	(24)	(22)	(24)	(21)
Whitaker - Total	-2.89	-3.36	-3.52	-3.07	-1.78	-1.41	0.33
	(44)	(44)	(53)	(53)	(44)	(53)	(45)
One Year	-2.92	-3.35	-2.67	-2.87	-1.61	-0.90	0.55
	(34)	(34)	(41)	(41)	(34)	(41)	(35)
Two Year	-2.80	-3.39	-3.02	-3.74	-2.36	-3.16	-0.44
	(10)	(10)	(12)	(12)	(10)	(12)	(10)

Table E.3
Language Usage Standard Deviation Means for Prescription Learning Students by Years in Program by School

School	Fall 81	Spring 82	Fall 82	Spring 83	GROW 81-82	GROW 82-83	RATE
Applegate	-2.46	-2.61	-3.48	-2.94	1.53	1.56	-0.01
	(8)	(8)	(14)	(14)	(8)	(14)	(8)
Beach	-1.90	-1.92	-2.01	-1.64	0.22	1.05	0.81
	(13)	(13)	(27)	(27)	(13)	(27)	(14)
Buckman	-3.98	-3.40	-3.42	-2.73	1.63	2.58	-0.16
	(12)	(12)	(33)	(33)	(12)	(33)	(20)
Clarendon	-3.78	-3.66	-3.66	-1.65	-0.78	5.61	3.64
	(12)	(12)	(32)	(32)	(12)	(32)	(15)
George - Total	-2.96	-3.44	-3.87	-3.07	0.45	2.61	1.78
	(36)	(36)	(45)	(45)	(36)	(45)	(42)
One Year	-2.87	-3.78	-3.65	-2.93	-0.70	2.27	2.24
	(25)	(25)	(29)	(29)	(25)	(29)	(29)
Two Year	-3.15	-2.69	-4.26	-3.32	1.11	3.23	0.75
	(11)	(11)	(16)	(16)	(11)	(16)	(13)
Ockley Green - Total	-3.67	-2.73	-3.29	-2.93	3.24	1.50	-0.99
	(59)	(59)	(73)	(73)	(59)	(73)	(60)
One Year	-2.54	-2.42	-3.11	-2.65	-0.23	1.94	1.14
	(28)	(28)	(38)	(38)	(28)	(38)	(29)
Two Year	-4.69	-3.01	-3.50	-3.24	3.67	1.02	-2.98
	(31)	(31)	(35)	(35)	(31)	(35)	(31)
Kelly	-3.11	-3.24	-3.68	-3.20	-0.80	1.56	1.91
	(26)	(26)	(48)	(48)	(26)	(48)	(27)
Kellogg - Total	-3.74	-3.00	-3.21	-3.04	1.64	0.69	-0.88
	(47)	(47)	(56)	(56)	(47)	(56)	(52)
One Year	-3.00	-2.39	-3.01	-2.98	0.72	0.21	-0.74
	(23)	(23)	(33)	(33)	(23)	(33)	(31)
Two Year	-4.44	-3.58	-3.48	-3.13	1.92	1.38	-1.10
	(24)	(24)	(23)	(23)	(24)	(23)	(21)
Meek	-1.85	-1.54	-1.97	-2.29	2.11	-0.89	-2.08
	(23)	(23)	(38)	(38)	(23)	(38)	(25)
Sellwood - Total	-3.42	-2.93	-3.99	-3.58	0.52	1.42	-0.14
	(41)	(41)	(56)	(56)	(41)	(56)	(54)
One Year	-3.68	-3.04	-4.39	-3.79	-0.31	1.99	-0.06
	(20)	(20)	(32)	(32)	(20)	(32)	(32)
Two Year	-3.19	-2.84	-3.45	-3.29	0.68	0.67	-0.26
	(21)	(21)	(24)	(24)	(21)	(24)	(22)
Whitaker - Total	-3.31	-3.24	-2.82	-2.83	-0.19	-0.05	-0.03
	(45)	(45)	(50)	(50)	(45)	(50)	(41)
One Year	-3.26	-3.13	-2.77	-2.62	-0.12	0.56	0.20
	(33)	(33)	(40)	(40)	(33)	(40)	(31)
Two Year	-3.44	-3.55	-3.02	-3.67	-0.27	-2.46	-0.73
	(12)	(12)	(10)	(10)	(12)	(10)	(10)

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